Does one size fit all?

Some lessons from monetary policy in the crisis years

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Preface

Thanks to my supervisor Asbjørn Rødseth for his time spent on remarks, suggestions and for correcting the mistakes I have done in the process of writing this thesis.

When I started my studies in economics five years ago one of the things that motivated me was the desire to understand macroeconomic issues that are discussed in news, social gatherings and general policy debate.

Through these five years as a student in economics, monetary policy and international macro are the areas that have interested me the most. My years of schooling in economy have presented me for academic tools, models and concepts to discuss and understand economic issues. In this thesis I will use these tools to shed some light on the functioning of the European Monetary Union.

This paper makes use of simple statistical procedures. It consists of mostly hypothesis and less proofs and is best understood as general contribution to the discussion of the big puzzle about the functioning of the EMU.

Abstract

This thesis attempts to shed some light upon the functioning of the EMU. The discussion is presented in the light of established monetary policy and optimal currency area-theory. The chapters two, three and four present relevant economic theory for our later discussion. In chapter five I address large differences in inflation and output gap between EMU-members in the last decade – with the difficulties this meant for conducting a single monetary policy optimal for all EMU countries. In chapter six I take a closer look at the deviant in the EMU, Ireland, and how their adverse economic behavior resulted in ill-suited monetary policy that amplified problematic economic developments and a house bubble. Chapter seven assess the consequences of the EMU-membership by comparing to approximately similar countries exposed to different monetary regimes. Generally this thesis discusses the functioning of the EMU by addressing lessons from monetary policy in the last crisis years.

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1 Introduction

The last 15 years have been a time with several economic crises and events. We have seen the Asian crisis in 1997-1998, the creation of the European Monetary Union (EMU) in 1999, the global financial crisis in the autumn of 2008 and the euro debt-crisis from 2010.

This thesis will discuss the functioning of the EMU-project in relation to the crisis years from 2008 and up to the present date. This will be assessed in light of existing optimal currency area theory (OCA) and monetary policy theory. Whether EMU can be considered an optimal monetary union is large discussion. I will try to shed some light upon this discussion using some specific approaches.

The European monetary union was effective from 1999, with euro banknotes and coins not introduced before 2002. First, eleven countries joined (Belgium, Germany, Ireland, Spain, France, Italy, Luxembourg, the Netherlands, Austria, Portugal and Finland), and as of 2013 the EMU consists of seventeen countries (Greece 2001, Slovenia 2007, Cyprus and Malta 2008, Slovakia 2009 and Estonia 2011).

In the first years few argued the EMU's success. Growth was high in almost all member countries, and some countries in the periphery stood out with even higher growth than the core. Unfortunately the economic prosperity did not last forever.

Today the situation in the EMU is quite different from what it was the first years after the creation. At present the EMU is experiencing high unemployment and slow growth. In March 2013 the overall unemployment rate was measured to be 12.1 % (Eurostat), and youth unemployment even reaching the double of this number in many countries.

To which degree is some countries problems today related to their membership in the EMU? There exists a lot of theory on what needs to be present for a monetary union to work optimal. In this thesis I will present some of this theory, including some monetary theory, and then discuss the EMU-project with these aspects in mind. I will mostly use the Taylor rule as a point of departure for how the national economies would have liked to see monetary policy being conducted.

Did the divergences between the members become too big? How ill-suited did the single ECB interest-rate become for some members? Would some countries have had advantages from

being able to conduct a different policy both before and after the crisis in 2008? Have any countries been able to utilize their position outside the EMU? This is the kind of questions I try to address in this paper. For this purpose I draw on research papers, statistical databases (OECD and Eurostat) and my own analyzes. Alongside a general assessment of the differences within the EMU I approach these questions in two distinct ways. First, taking a closer look a country (Ireland) that might have had too different economic performance from the core of the EMU, and second, comparing a country within the union with a country outside (Netherlands and Sweden).

The chapters 2-4 go through theory central for our later discussion. Chapter 2 consists of monetary theory I find relevant and the arguments for the inflation-target framework present in most developed economies today. Chapter 3 is an introduction to some of the key-concepts in OCA-theory. Chapter 4 looks into the role of the ECB, their tools and objectives, and describes the instruments they have at their disposal for conducting monetary policy. The last 3 chapters seek to explore some of the problematic aspects of the EMU project the last crisis years. In chapter 5 I try to address the differences in economic performance between the EMU-countries. Here I also look at the differences between what interest rate a Taylor-rule would predict for each country and what was set by the ECB, and address differences in inflation rates and output-gaps within the EMU. I use the Taylor-rule as a proxy for how a hypothetical national central bank would have liked to see monetary policy being conducted. Chapter 6 takes a closer look at Ireland as the deviant in the EMU, with economic activity diverging excessively from the core, and try to address whether they could have utilized from having a national central bank. Chapter 7 is an attempt to assess whether it could have been advantageous to stay outside the currency union through the last year's economic distress. To do this I compare Netherlands and Sweden. Netherlands as member of the currency union and exposed to the monetary policy the ECB decides upon, and Sweden with a national central bank with the possibility to conduct independent monetary policy. In this chapter I try to assess whether different economic performance can be related to their different policy regimes, namely, whether Sweden's role outside the EMU is the source of different economic performance from the Netherlands.

At last I summarize my discussion and make concluding remarks.

2 Key concepts in monetary policy

2.1 Monetary policy

Monetary policy theory is concerned with understanding the relationship between nominal and real variables. Such as real GDP, real interest rates and unemployment on the hand, and inflation, nominal short term interest rates, nominal exchange rates and money supply on the other. Monetary policy in a more practical sense is occupied with understanding the real effects of central banks actions. The role of monetary policy is to maximize welfare of the public, and which way to pursue this is what theory of monetary policy deal with.

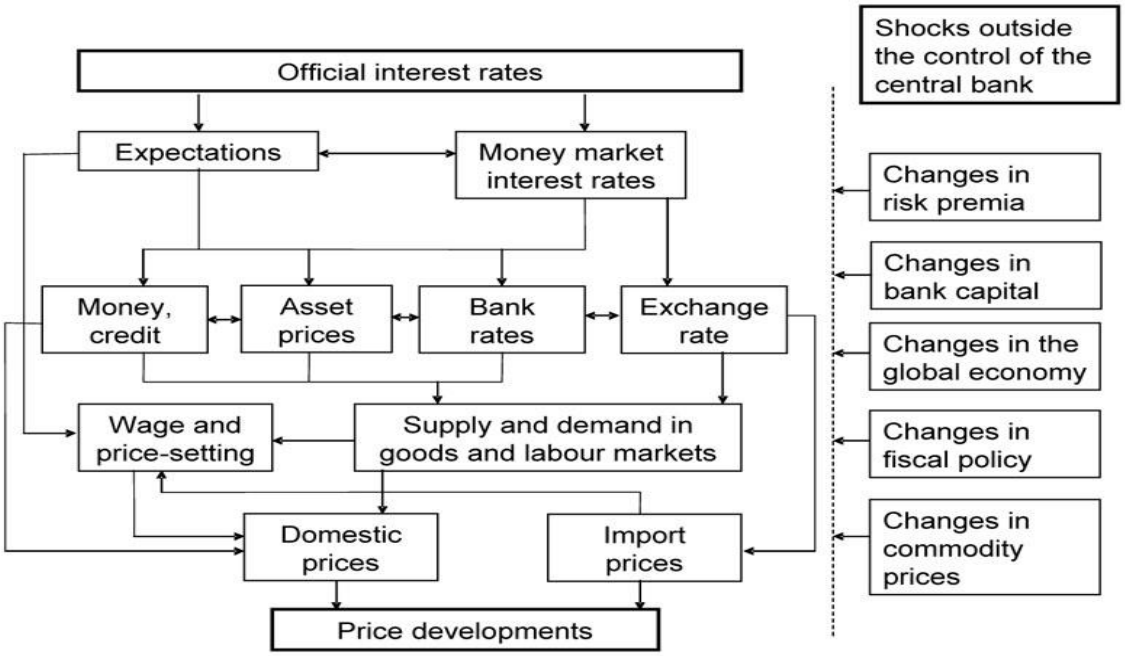
A central model to discuss the time-inconsistency problem with monetary policy is the Barro-Gordon model(Gali 2008). This model discusses the time-inconsistency problem that arises if central bankers conduct discretionary monetary policy with preferences over inflation and output, and the public have rational expectations. With discretionary policy central bankers will always have a short-term gain from creating surprise-inflation and boost output, creating an inflation-bias. The solution to this problem was proposed in a well known paper from the 1980s published by Kenneth Rogoff: *"Society can sometimes make itself better off by appointing a central banker who does not share the social objective function, but instead places "too large" a weight on inflation-rate stabilization relative to employment stabilization"* (Rogoff 1985). This described regime is the most common practice in modern economies today and made the theoretic foundation for the principal-agent framework; that independent central bankers follow a contract set by the government with the objective of achieving an inflation target.

2.2 Instruments in monetary policy

A central bank has two instruments in their execution of monetary policy - the interest rate and communication, with the interest rate being the primary. The transmission mechanism of the central banks official interest rates influence on inflation can be illustrated in several ways, and in figure 1 I have included a graphical illustration of how the ECB (most relevant central bank) interpret the transmission. The key policy interest rate set by the central bank has a direct effect on money market interest rates and inflation expectations, and a lagged effect on variables such as unemployment, inflation and GDP. The key-policy rate generally

works through the demand-channel, the expectation-channel and the exchange rate-channel - all affecting the real economy eventually in an environment where the official rate affects the money market rates. In a real-world setting it is important to keep in mind the shortcomings and caveats with this picture. There are two specific aspects to keep in mind - informational problems, and time lags - both internal and external. First, it is not obvious that the information the central bank have about the economy is absolutely correct. Second, it takes time from when changes in inflation and the output gap reach the central bank (internal lags) and make them capable of responding, and on the other sides it takes time before monetary policy responses from a central bank influence the real economy (external lags).

Figure 1 - The transmission mechanism of interest rates



Source: http://www.ecb.europa.eu/mopo/intro/transmission/html/index.en.html

The interest rate set by the central bank is the most recognized and obvious instrument used when conducting monetary policy and achieving the inflation target, but communication is also an important one. A few decades ago the convention among central bankers was to relieve as little information as possible about their monetary policy. The recent year's development has been to be more open about their objectives, intentions and actions. The reasons for a more open communication were, I think, summed up in a speech by Lucas Papademos, Vice President of the ECB at the Annual Meeting of the Allied Social Science Associations New Orleans, 5 January *2008*:

"Nowadays, it is widely recognized that increased transparency and enhanced communication are essential and beneficial ingredients of an effective monetary policy. There are several reasons for this. These are related to the democratic legitimacy of independent central banks, the efficient functioning of the economy and the effectiveness with which monetary policy can attain its objectives."

Enhancing the effectiveness of attaining the central banks objectives, and increasing the accountability with respect to their targets can be achieved through communication. Announcing the explicit inflation target can also help anchoring the inflation expectations among wage- and price-setters.

There are several examples of communication as an explicit central bank instrument from the last years. In the US the American federal reserve in an official statement on December 12.2012 announced it will keep interest rate near zero until unemployment was down to 6.5%. This might be seen as trying to increase the accountability. And Mario Draghi used it, in July 2012 on an investment conference in London, when the debt crisis was close to its peak and he pledged to do whatever was necessary to protect the euro zone from collapse, including fighting soaring government borrowing costs. His words were "Within our mandate, the ECB is ready to do whatever it takes to preserve the euro. And believe me, it will be enough". Here trying explicitly to convince the public that the ECB will achieve its goals.

2.3 The Taylor rule

When discussing costs and benefits of a monetary union a central part we will be concerned with whether the interest rate set by a central bank is optimal for its members or not. A concept used for discussing the optimal interest rate is a Taylor type rule. Sometimes conducting and understanding monetary policy can be very complex. This rule serves the purpose of creating a mechanical concept for setting the nominal interest. Such a mechanical framework is advantageous when we want to simplify the assessment of monetary policy.

The monetary policy-rule later named the Taylor rule was proposed by John Taylor in a paper from 1992. According to this paper this policy rule can serve two purposes. First, it is a good description of monetary policy setting on US data in the period 1987-1992, and second, he argues why it is a good rule to follow for future conduction of monetary policy (Taylor 1993).

His main argument is that the Taylor-type rule is the most successful in achieving price stability and output-stability in comparison with other types of monetary policy-rules (in the period 1987-1992) in other countries (Taylor, 1992, p. 6).

The Taylor-rule predicts an interest rate from three explanatory variables; the equilibrium real interest rate, the output-gap and deviation from inflation target. The rules describe how a central bank should behave when inflation deviates from its target. Also it puts emphasis on the utilization of the resources in the economy, and explicitly whether the output-gap is above or below zero.

Two obvious shortcomings with a Taylor-type rule are that it does not take foreign interest rate and the exchange rate explicitly into account. A central bank might be influenced by the interest rate set by their trading partners because of the objective to avoid exchange rate fluctuations. F. ex if we assume the ECB was concerned with not deviating from the US key interest rate in the years leading up to the 2008 crash, it is easier to reason why the interest rate was set as low as it was.

This predicted rate of interest can be helpful when evaluating a central banks policy, and I find it helpful as a point of departure for our discussion. In some central banks specific loss functions is also used as a guideline for conducting monetary policy, such as in the Norwegian Central bank, but in this thesis I will mostly use the Taylor rule for analyzes. The Taylor-rule is a good benchmark for analysis, but also has some shortcomings which is important to have in mind, and do not take into account all the variables most central banks base their decisions on. The Taylor-rule might first and foremost be seen as easy-to-understand benchmark when assessing monetary policy.

Taylor type interest rate rule[1]

$$r_t^* = \pi + \dot{\pi}^* + a_\pi(\dot{\pi}_t - \dot{\pi}^*) + a_y(x_t).$$

r_t^* - Desired interest rate

π – Long term real interest rate

$\dot{\pi}^*$ - The central banks inflation target level

[1] De Grauwe, 2009, p.179

$\dot{\pi_t} - \dot{\pi^*}$ - Inflation-deviation from target level

x_t – Output-gap

a_π – The central banks weight on stabilizing inflation (must be set above one for the Taylor-principle to hold).

a_y – The central banks weight on stabilizing the output-gap.

The desired interest rate is the rate that is optimal according to this policy-rule based on given values for inflation, the output-gap and the long term interest rate.

The inflation target is most often set low, but above zero. In Norway the target level of year-on-year inflation is set to 2.5 % in the medium run, while in the Eurozone it's expressed as close to 2 %.

a_π, a_y, is the weight on stabilizing respectively inflation and output. For the Taylor-principle to hold this parameter must be above 1 (more on this in Taylor-principle). Often this value is set to 1.5(See f.ex De Grauwe 2009). The value a_y is often set to approximately 0.5. This is because stabilizing inflation is often a more important concern for the central bank than the output-gap. Also some would argue that stabilizing inflation near its target is enough for the output-gap to be stable, which would imply no need for stabilizing output at all. This property has been named the *divine coincident* by Jordi Gali and Oliver Blanchard, but its realism is still up for debate among academics.

This desired interest rate we get out of our calculation is to a large degree decided by which value we set on the long-term natural rate of interest. This level is difficult to set accurately and studies have been done alone just to find these levels. (Clark and Kozicki 2005).

Taylor-principle

The coefficient a_π must be above 1 for the Taylor-principle to hold. So the central-bank must respond by more than one-to-one with deviations in inflation from target. If, say, inflation increases with one percent, the interest rate must increase with more than one percent for the real rate of interest to increase and dampen the economy. If the interest rate only would respond by say 0.9 % to a 1 % inflation increase the real rate would actually decline with 0.1 and inflation could increase when it is actually intended to decrease, and this would stimulate an economy already above full resource utilization.

3 Economics of a monetary union – theory of an optimal currency area

There are some economic aspects which is important to have in mind when we are discussing costs and aspects related to being a member of a monetary union. Some of these principles I will go trough in this section. The costs of joining a monetary union come mainly through countries losing an instrument in their national monetary policy. The national central bank loses the possibility of changing the price of its own currency (devaluations or revaluations) and the short term interest rate. Thus, an independent national policy is no longer possible. A single policy can create problems if the countries within the union have different economic performance and neither seems to converge. Optimal currency area (OCA) theory tries to assess the aspects that are central to consider when we discuss the optimality of a currency area, both ex ante and ex post. Recent development in the discussion of OCA has been to discuss whether the formation of a currency union is endogenous on the factors that decide the optimality of the currency area. This view argues that potential member-countries will most likely fulfill the OCA criteria better ex post, than ex ante. Namely that becoming a member of the currency union will alone improve the criteria that make the country an optimal member of the currency area. In this section I will mainly discuss the criteria important to fulfill once the union is created (ex post). The explicit ex ante criteria for the EMU is mentioned in subchapter 5.1. The ex post criteria is most commonly referred to as automatic stabilizers. Ex ante criteria are general criteria that secure similarity between potential members.

3.1 Different economic activity and shocks within a monetary union

If several countries within a monetary union are hit by a common shock we call this a symmetric shock. An example of a shock that was to a large degree symmetric in its nature was the financial crisis in 2008. All countries in the Eurozone experienced a much correlated fall in economic activity after this negative demand shock. So inflation and GDP reacted initially in much the same way in all countries within the EMU. This kind of shock is easier to cope with for a central bank than when shocks are asymmetric. In a situation like this, with a symmetric shock, an interest rate decrease to boost growth is what suits all members. When

the severity of a shock and, in some cases, the sign of the demand shock is different for different countries, we call this an asymmetric shock. Now one type of monetary policy might be good for one member-country and bad for another. One country might need to dampen growth, while another needs a boost. This calls for different mechanisms to rebalance the different countries economies.

There could also be divergences stemming from different growth rates over time. One country might grow much stronger than another country within the same monetary union, resulting in different output-gaps and inflation rates. This could then make one country in need of contractive monetary policy and another one in need of expansionary policies. Two needs which is difficult for one central bank to accommodate.

The key problem of adverse economic activity in a CU is what this leads to in a longer-term perspective. A country with activity different from the core of the area might be exposed to an interest rate that will be pro-cyclical on economic activity. It might boost an economy already above full resource utilization, or further depress an economy with a negative output-gap. With only one monetary policy, adverse economic activity in a CU might make the central bank unable to conduct welfare maximizing policy for all respective member countries.

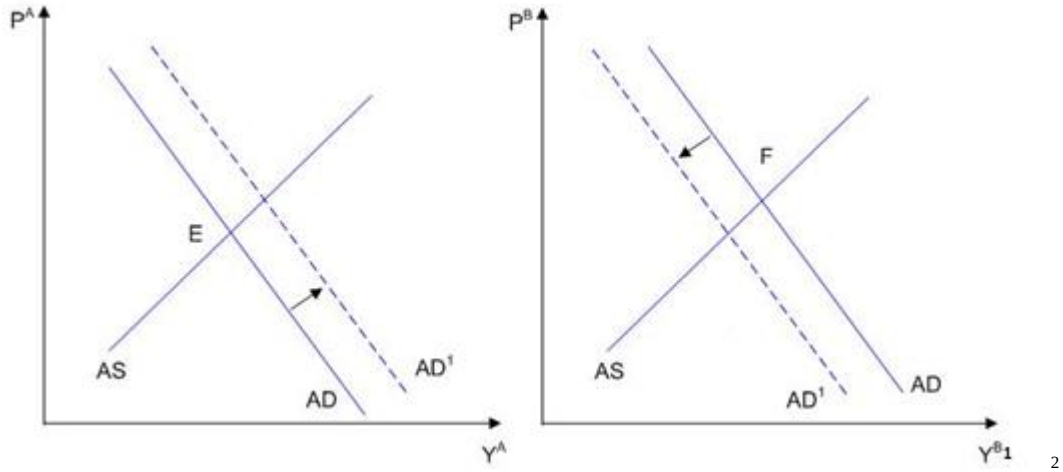
3.2 Automatic stabilizers in a monetary union

When a country enters a monetary union the possibility to adjust for national demand-shocks by using the interest rate disappears. The decision of the optimal interest rate is now decided by analyzing the activity in the whole union. In optimal currency area (OCA) theory, labor mobility and wage flexibility – often called automatic stabilizers- can work to even out the effects of an asymmetric demand shock or general adverse economic performance. I will now explain how this might work.

Analyzing asymmetric shocks

We use the Mundell-Fleming model for discussion. The shocks are illustrated using curves for aggregated demand and aggregated supply (AS-AD) in an open economy, explaining the price level and output through the relationship of supply and demand.

Figure 2 - Effect of adverse demand shocks



[2]

We allow for two different demand shocks to occur in country A and B. Increased demand for goods in country A will lead to inflationary pressure, and demand curve shifting to the right. While decreased demand in country B leads to increased unemployment and reduced inflationary pressure, shifting demand curve to the left.

With national monetary policies country A might want to use contractive policies while B prefer expansive.

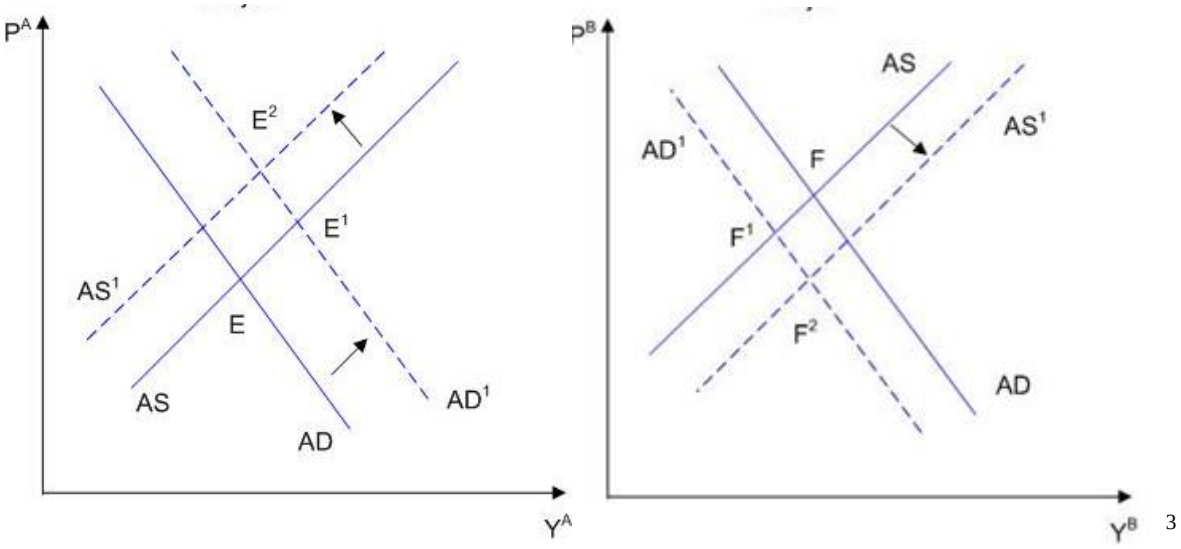
When these two countries find themselves in a currency union the central bank is unable to adjust for such an asymmetric shock and the central bank becomes paralyzed. We therefore have to look for other mechanisms to work this out.

In a currency union, using the Mundell-Fleming model, there are two main mechanism which can work to stabilize this asymmetry. *Wage flexibility* and *mobility of labor*.

First, let us look at wage flexibility. If wages in both A and B are flexible, increased unemployment in country B would lead to workers reducing their wage claims, and decreased unemployment in A will lead their workers to increase their wage claims. This will lead to opposite shifts in the supply curves in the two countries because firms wage cost will differ. These shifts are shown in figure 3.

[2] DeGrauwe, 2009, p.6

Figure 3 - Adverse demand shocks and effects when wages are flexible



[3]

The reduced wage claims in country B lead their firms to be able to produce more profitably and their supply curve shifts downward. The opposite mechanism happens in A. So we are back in equilibrium E^2 in A, and F^2 in B. This wage-flexibility work to increase country B's competitiveness, thus its demand, and reduce demand in A.

Mobility of labor. This might work as an additive or substitutable mechanism to rebalance an asymmetric shock. If labor is mobile, increased unemployment in B will make workers migrate to A, where there is increased demand for labor, and reduce unemployment in B. This will work to eliminate wage pressure in A, and wage reduction in B. If, say, Germany has low unemployment, while Spain has a high level, a high degree of labor mobility will make unemployed Spaniards move to Germany where it is easier to find vacant jobs. This will make unemployment rates decrease in Spain and increase in Germany.

So wage flexibility and mobility of labor is two basic conditions for a currency union being able to absorb asymmetric shocks and adjust properly. If these automatic stabilizers work accordingly, asymmetries within a monetary union will be rebalanced and the need for different monetary policy will not be a problem. To secure mobility of labor and wage flexibility then becomes a way of securing convergence within a currency union (CU). This mechanism is referred to as ex post criteria in OCA-theory.

[3] DeGrauwe, 2009, p.7

3.3 Exchange rate economics - effect of devaluations

With high capital mobility, the capital movements decide the exchange rate in the short run. These movements are affected by interest rates, expectations and perception of risk. If we assume uncovered interest rate parity (UIP) holds the rate of depreciation is decided by interest rate differences. With UIP a country can depreciate their currency by keeping interest rates lower home than abroad.

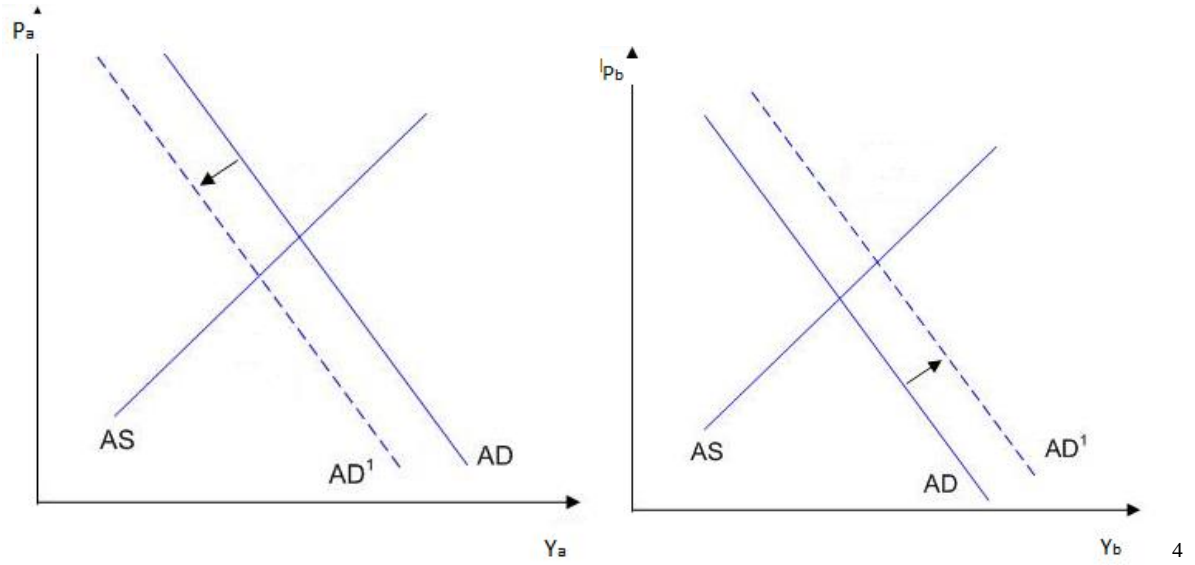
With only one currency the possibility of gaining competitiveness against other members and increase demand through devaluations of its currency becomes impossible. So let us look at a scenario in connection to this.

First we consider what would happen to the exchange rate when two countries are hit by asymmetric shocks, and they have not yet entered a monetary union. Now the two countries would be free to use national monetary policy to adjust economic activity and the price of its own currency.

We still assume country A is experiencing a positive demand shock and B a negative. Now consider effects of a given policy from the national central bank. We assume the country allow exchange rates to fluctuate. Here country A's central bank could step in to decrease inflation by increasing interest rates and reduce economic activity. While in B the central bank could reduce interest rates to increase inflation and boost economic activity. In a case like this, if we assume uncovered interest parity, we would expect country B's currency to depreciate because of investors increased demand for the currency with the highest interest rate, causing their goods to become more competitive, while country A's currency would appreciate. This will increase demand in B and decrease demand in A. This might then lead the two countries production back to equilibrium.

The effects on aggregate demand from this monetary intervention is illustrated in figure 4 were demand in A is reduced and demand in B is increased. Here we assume the initial negative effect on demand from the shocks has already occurred.

Figure 4 - Effect of devaluation as a response to adverse demand shocks



[4]

This is no longer a possibility for countries within monetary union experiencing asymmetries. Thus, when a country enters a currency union the opportunity to adjust economic activity by devaluations is lost.

3.4 Different growth rates

Some countries within a union might grow much faster than others, like Ireland in the years 2000-2008. This could become a problem if the fast growing countries' import grows faster than its export and their trade account deteriorates. In a currency union the fast growing country can not solve this by internal devaluation, and national policies to curb inflation and growth might be of limited availability - all this making an argument for the need of convergence and similarity between the member countries to avoid divergent economic performance.

Another source that might cause divergence is different productivity growth in the traded sector between countries in a CU, this can lead to difference in inflation rates. This effect is called the Balassa-Samuelson effect (Balassa 1964). This might have been what happened to Ireland after they became a member of the euro. Because of large foreign direct investments their yearly productivity growth was higher than in the rest of Europe and caused inflation rates to also differ from the core of Europe. With such differences in inflation rates within the

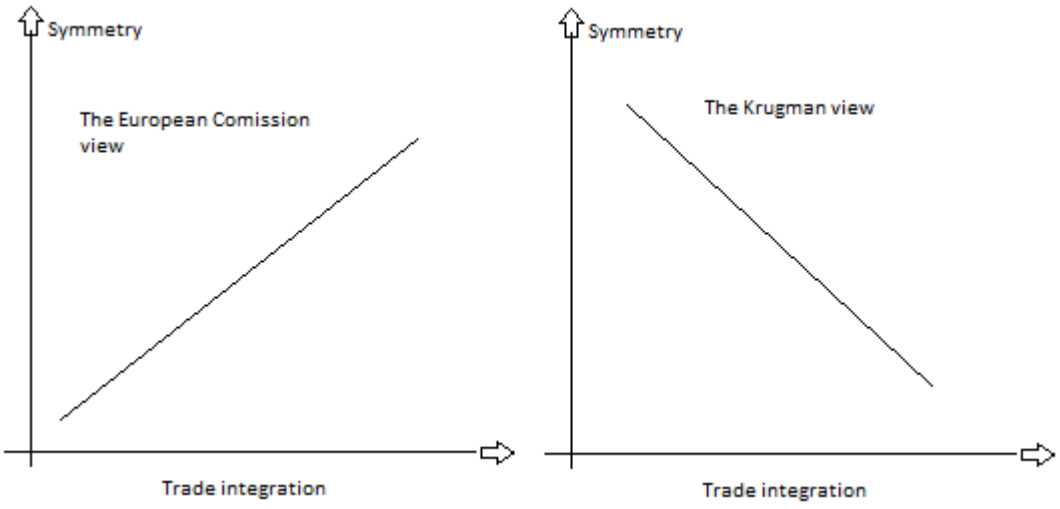
[4] DeGrauwe, 2009, p. 8.

CU the real-rates will deviate and have diverse implications for the stimulation of economic activity within the union, and hence amplify asymmetric developments.

3.5 Krugman approach vs. European commission approach.

These two views have different opinions on how trade integration affects symmetry between countries, and the possibility of asymmetric shocks occurring. This discussion is at the heart of whether the creation of a currency union is endogenous on the ex ante criteria. Do countries that form a monetary union become more similar or do they specialize in production of different goods and become more different? Some argue that creating a currency union will accelerate integration and convergence, while the opposing view argues that creating a common currency should be the last crowning of integration. These different arguments have been summarized into two different names commonly referred to as the *European commission view* and the *Krugman view*. Below I have illustrated them graphically.

Figure 5 - Symmetry and trade integration



[5]

Will further trade integration lead to more or less chance of asymmetric shocks occurring? In accordance with the European commission view trade integration will lead to *more symmetry*. Trade between the European countries is mostly intra-industry trade, and this trade will increase with more integration. Germany buys cars from France and vice versa. So in this

[5] De Grauwe, 2009, p. 25

environment when consumers reduce their demand for cars this affects the countries in mostly the same way, so asymmetric shocks are less likely to happen.

In accordance with the Krugman view, more trade integration leads to *more specialization*. More integration leads to more regional concentration and agglomeration of industrial activity. So moving closer toward one European market, specific industrial activities will tend to concentrate geographically. Then production of say computers will be specific for one region or country. So shocks to a specific sector will tend to hit countries or regions more specifically. Which one of the two views are correct is not clear, but if the Krugman view is correct this will make asymmetric shocks a larger concern as Europe moves towards greater integration. On the other hand you could argue that trade integration will lead too concentration of economic activity, but independent of national borders. Say car industry might agglomerate in an area including both country A and country B. This way a shock to that industry will hit both countries, but still there would be several other countries that will not experience this shock, and this would still make a problematic case when there is only a single monetary policy to adjust this asymmetry.

3.6 The most important benefits from sharing a common currency.

Going through OCA-theory there might be easy to conclude there are mostly problems in sight, but this could of course not be the case, or else a union like the Euro would never have been created. The benefits of a currency-union (De Grauwe, 2009, ch. 3) are easy to forget in our assessment and I have briefly included some of most apparent ones below.

Reduced transaction costs. Actors in the market will no longer have to pay transaction costs when exchanging currency to pay for foreign goods. This is maybe the most obvious benefit, and has practical benefits because people do not have to exchange money within the Eurozone, but the direct exchange rate cost also disappears.

Reduced exchange rate speculation. An activity which can be argued whether adds any fruits to society at all, and assuming it doesn't, reduction of this activity can be looked as a welfare gain.

Price transparency. With only one currency it might be easier for consumers to compare prices on the same goods across countries. So tradable goods might converge in price to a larger extent than before, and lead to more competition.

Reduced exchange rate fluctuations. If firms in a monetary union are risk averse they will to less extent have to fear income fluctuating because of volatility in their exchange rates. Eliminating this uncertainty can be understood as a welfare gain.

These benefits add up to an environment that hopefully will lead to more trade among the members in the union, and increased trade alone, considering classic economic theory, will increase the welfare of the people in the union.

3.7 The core message in OCA-theory

Adverse economic performance and differences in a monetary union, with only one monetary policy can be solved by:

1) Ex ante: securing convergence and similarity between the members, thus reducing the probability of asymmetric shocks or divergent growth rates materializing.
2) Ex-post: making sure automatic stabilizers like wage flexibility and labor mobility is strong enough to account for uneven economic performance once they have occurred.

4 The ECB – objectives and instruments

The ECB overtook all the responsibility of conducting monetary policy in the Eurozone when stage three of the EMU-creation was enacted and the union was created in 1999. It was now supposed to be the central bank on behalf of all its different members - a complex task. In this section I will go through the main characteristics of the ECB.

To deal with the problem of dynamic inconsistency the European Union has made a principal-agent contract with the central bank to take care of monetary policy, as done in most developed economies. The objectives of the ECB are expressed in the Treaty on the functioning of the EU.

"*In accordance with Article 127(1) and Article 282(2) of the Treaty on the Functioning of the European*
Union, the primary objective of the ESCB shall be to maintain price stability. Without prejudice to the objective of price stability, it shall support the general economic policies in the Union with a view to contributing to the achievement of the objectives of the Union as laid down in Article 3 of the Treaty on European Union». (On the statute of the European system of central banks and of the European central bank, official journal of the European union, 9.5.2008). It here creates a clear hierarchy of its objectives, with price stability being the most important one. Further it says "*..it shall support the general economic policies in the union*". According to the ECB this is understood as full employment and balanced economic growth. So even though price stability is the primary objective, contributing to a sound economic environment is also of expressed importance.

The ECB governing council has defined price stability as year-on-year increase in Harmonised Index of Consumer Prices (HICP) below, but close to 2%. This target is to be achieved in the medium term, allowing for short term deviations in the short run.

4.1 Instruments of the ECB

The ECB has several instruments they can use to achieve their objectives. In their operational framework they use open market operations, standing facilities and minimum reserve

requirements. They can also use communication to affect expectations. All these instruments are used to influence the real economy. Open market operations are the most important tool the ECB have to affect the economic activity (De Grauwe, 2009. p. 215). In the open market operations the central bank allots liquidity to a given rate or different sums to different rates. These transactions are performed through tenders called *main refinancing operations (MROs).* The interest rate set on these MROs is called the repo rate. Later when I refer to the key policy rate set by the ECB I refer to this repo-rate set on the MROs. These operations can be done through fixed rate or variable rate tenders. In variable rate tenders the repo rate works as the minimum rate the ECB will accept bids by the banks. The ECB also sets rates on the *deposit facility* and the *marginal lending facility.* The deposit facility can be used for overnight deposits by banks. The rate on these deposits is lower than on the MROs. The marginal lending facility is used by banks to obtain overnight liquidity, the rate on these loans are above the MROs. The aim of setting these different rates is to reduce or increase the liquidity in the money market, and affect the real economy through the established transmission mechanisms described in chapter one. The *reserve requirements* can also be used to affect the money market. This works in the way that an increase in the reserve requirement tends to decrease the money stock.

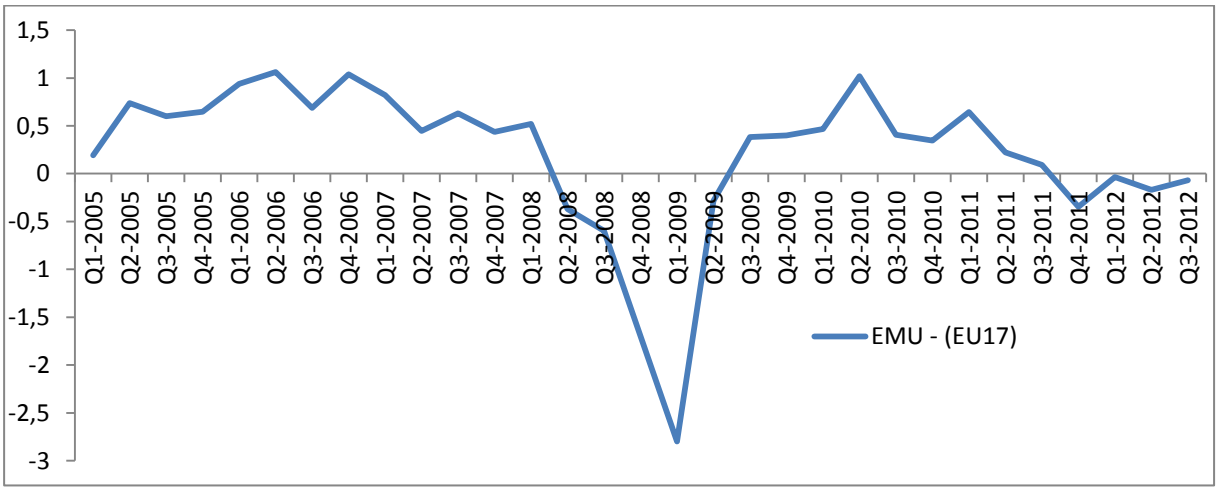
Additional to these instruments the ECB can use communication to improve effectiveness of their policies and strengthen accountability. After each monthly meeting of the governing council, the president meets the press to inform the public on what decisions has been made and why. This might be seen as a way of strengthen the central banks transparency and openness.

5 Assessing the asymmetry within the EMU

On the first of January 1999 stage three of the steps towards European integration was enacted. The euro was introduced and all responsibility for conducting monetary policy on behalf of the EMU-members was given to the ECB.

Figure 6 shows the average growth values in the EMU since 2005. The first years up to the financial crash growth was high and stable, but the economy went into severe contraction from autumn 2008. The growth rate picked up in the start of 2009, but went slowly downwards again when the euro-debt crisis materialized in 2010. Today the growth rate in Europe is close to zero, and some countries in the periphery still experience growth rates equivalent to contraction.

Figure 6 - Growth in GDP quarter on quarter in EMU 2005-2012



Source: Oecd

Independent of the causes the last decade has been a bumpy ride for the EMU, and generally the developed economies in the western world. First the financial crash in 2008 and then the sovereign debt crisis in Europe from 2010 has sees many economies troubling. The EMU, which first started as a happy child, have met difficulties in its puberty. In the first years several European economies were flourishing, and the EMU was perceived as a success. Now the situation is somewhat different. In March 2013 the overall unemployment rate was

measured at record high of 12,1% (Eurostat), and youth unemployment even reaching the double in many countries.

How does the troubles today relate to the countries membership in the EMU? And how ill suited did the single ECB-rate become for some countries? These questions I will address in the light of theory presented in the first two chapters.

As in most economic fields, there have been shed light on these questions before. A paper on related issues is from 2009 when John Taylor published a paper called *'The Financial Crisis and The Policy Response: An empirical analysis of what went wrong'*. In this text he addresses the Federal reserves monetary policy in the years before the financial crisis in light of the Taylor rule. Here he focuses on the US, but also touch upon related European problems. In Taylor's original paper he argues that the loose monetary policy from US central bankers was central in accelerating the American housing boom. He runs a regression relating housing starts to the interest rate, and then goes on to simulate housing starts had the Taylor-rule been followed, resulting in much lower housing start predictions. For Europe the paper address a high correlation between housing investments and deviation from a Taylor-rule. With Spain, Ireland and Greece standing out with the largest deviations from the rule, thus the highest investments in housing(Taylor 2009).

When evaluating monetary policy it is helpful to have an explicit point of departure. In this section I will discuss the ECB rate in light of the predictions using a Taylor rule.
To give a background for discussing the ECB-rate I have included the key policy rate-setting of the ECB since 1999 in figure 7 below.

Figure 7 – ECB's MRO rates 1999-2012

Source: Tradingeconomics.com

It gives a general picture of the economic conditions in Europe, and the ECBs response to it the last decade. You can see two peaks, one in start of the new millennium, and the other one in connection to the financial crash in 2008.

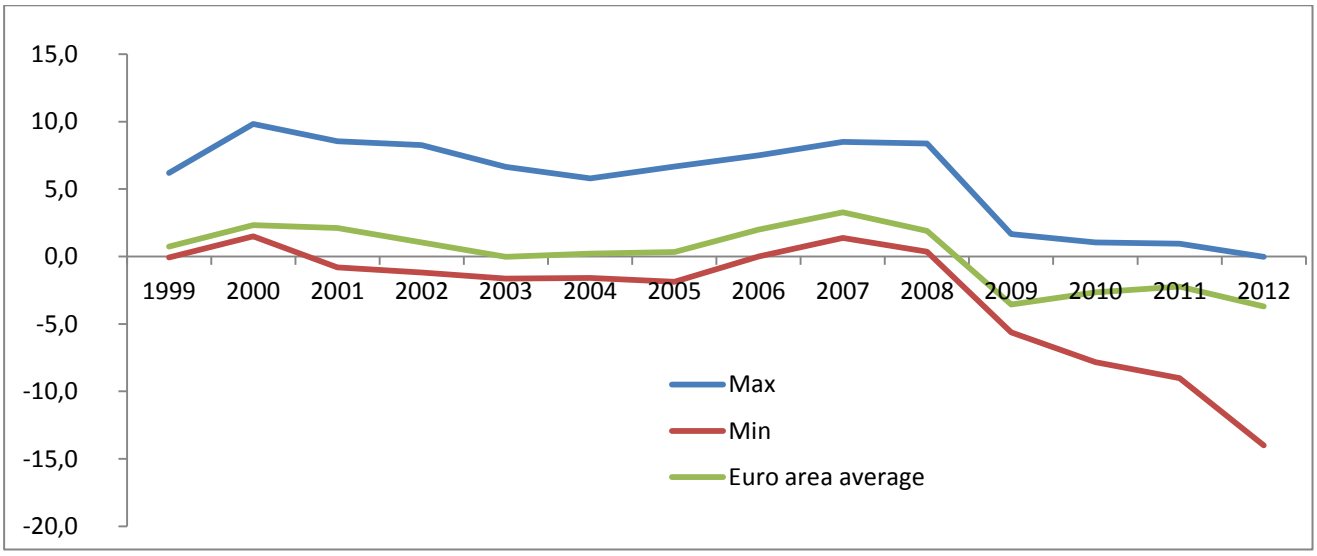
5.1 The asymmetries in the European Monetary Union

Since the start of the EMU-project the divergences between the members have been present. When asymmetries once have materialized ex-post criteria can help rebalance the differences. To secure convergence and reduce the chance of asymmetries actually developing countries should show similar results on economic indicators like inflation, public debt, exchange rate fluctuations and current accounts. These are called general convergence criteria to secure that the economies entering the CU is not too different in an economic sense ex ante. The convergence criterions in the Treaty establishing the European Community (EC Treaty) were meant to secure this similarity between the members adopting the currency. They were made upon four formative criterions members had to accommodate. Price stability, government finances, exchange rates and long-term interest rates had to be according to specific targets (Article 121(1) of the Treaty establishing the European Community (EC Treaty)).

Fulfilling these criteria were an important step to secure convergence and similarity between the members. Despite of these measures to reduce the risk of divergence the last decade have shown that EMU's members differed a lot in economic activity. In figure 8 I have included a

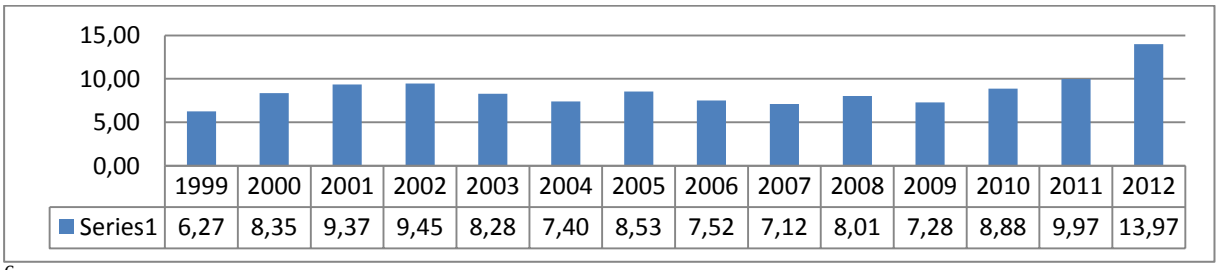
chart showing the most positive and the most negative measured output-gap in the period 1999-2012. This chart gives an overview of the differences present since the start of the single currency. In figure 9 I have calculated the deviations between the most positive and most negative output gap among EMU member countries measured each year. Showing increased differences in the years 2010-2012. With a difference of 13,97 % in output gap in 2012 – making it difficult to conduct a suitable monetary policy for all member countries.

Figure 8 - Maximum and minimum output-gap measured in EMU 1999-2012



Source: Eurostat and own calculations.

Figure 9 - % difference between the maximum and minimum output-gap in the EMU - 1999-2012



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Series1	6,27	8,35	9,37	9,45	8,28	7,40	8,53	7,52	7,12	8,01	7,28	8,88	9,97	13,97

[6]Source: OECD and own calculations.

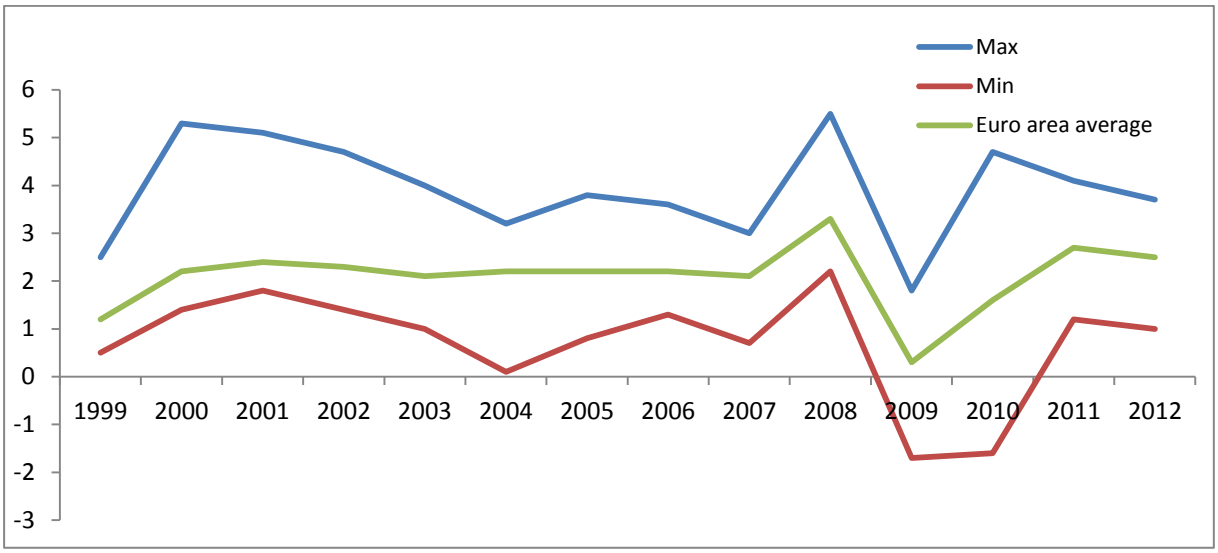
When the European monetary union was created most people realized that asymmetric shocks could occur, but policy makers took a chance that the union would be capable of handling these asymmetries, and that automatic stabilizers like wage flexibility, labor mobility and additional adjustments by the ECB would be enough to account for these. Today we got

[6] OECD calculations on output gaps follows a production function approach, this method takes into account the capital stock, changes in labor supply, factor productivities and underlying "non-accelerating inflation rates of unemployment" (NAIRU) (http://www.oecd.org/eco/outlook/forecastingmethodsandanalyticaltools.htm).

results from over ten years with the euro. Although it's not trivial to declare causation behind asymmetries and the problems in the Eurozone today, it's safe to say they have been part of the problem.

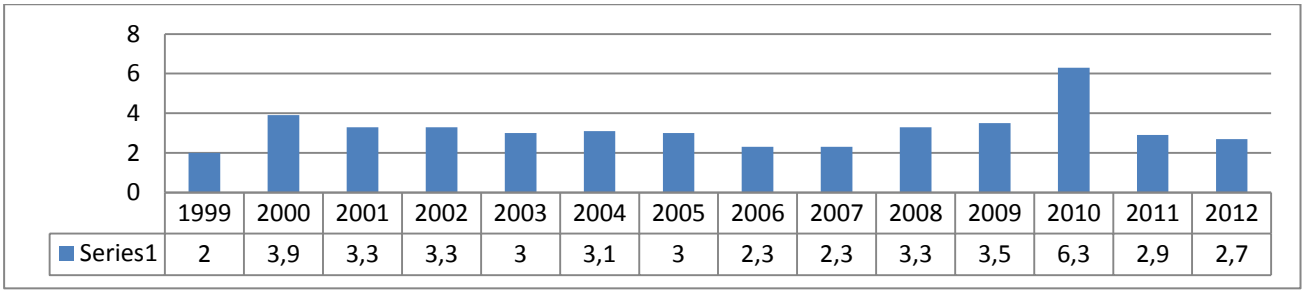
Having a single monetary policy is problematic when you have got inflation rates differing in the whole union. Figure 10 is a chart showing the differences in inflation rates within the Eurozone – making it clear the difficulties of conducting a monetary policy suitable for all members, and the fact that one single nominal rate set by the ECB gave severely different real rates. In 2010 when some countries in the EMU had severe debt-problems the difference between the max and min inflation was 6,3 %. In 2011 and 2012 the difference in inflation has been reduced while the difference in output gap has increased.

Figure 10 - Maximum and minimum measured inflation in the EMU - 1999-2012



Source: Eurostat and own calculations.

Figure 11 - % difference between minimum and maximum measured inflation rates in the EMU - 1999-2012



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Series1	2	3,9	3,3	3,3	3	3,1	3	2,3	2,3	3,3	3,5	6,3	2,9	2,7

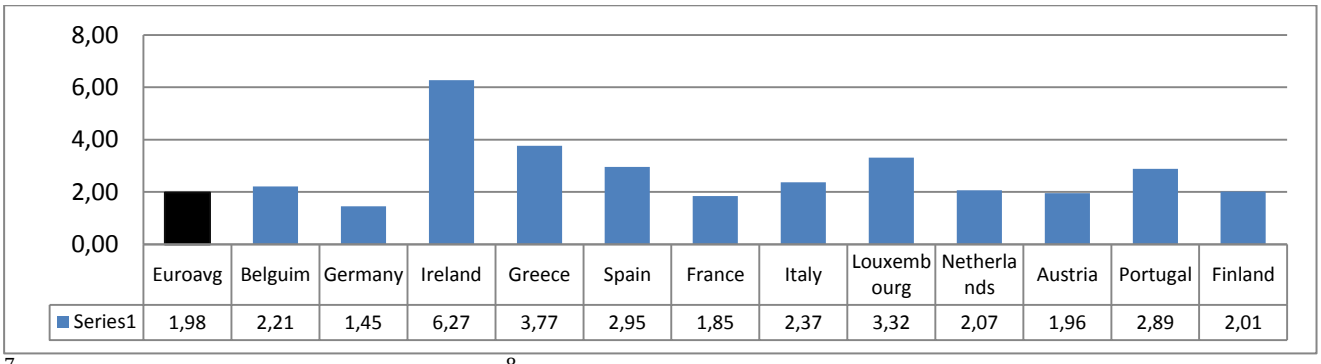
Source: Eurostat and own calculations

5.2 Assessing EMUs divergences using a Taylor rule

To give an insight into what countries that has been exposed to particularly ill-suited interest rates I have looked into each original member of the EMU plus Greece' situation.

Figure 12 is a chart showing average of absolute deviations from a Taylor-rule since the EMU was introduced and up to 2012. It is calculated as the predicted rate minus the ECB-rate. So values high above zero mean the country were exposed to rates far from what a national central bank following a Taylor rule would have desired. I have used annual values of inflation and output-gap, and then got a total of absolute deviations which I have averaged out dividing on number of years. So what you so below is the average of absolute deviations. I have used the Taylor rule presented in chapter one.

Figure 12 - Average of absolute deviation from Taylor-rule - 1999-2012



	Euroavg	Belguim	Germany	Ireland	Greece	Spain	France	Italy	Louxembourg	Netherlands	Austria	Portugal	Finland
Series1	1,98	2,21	1,45	6,27	3,77	2,95	1,85	2,37	3,32	2,07	1,96	2,89	2,01

[7]Source: Eurostat and own calculations[8].

This figure show average of absolute deviations for every original member in the EMU plus Greece, and all countries were exposed to interest rates way lower than what a rule like this suggested. These deviations are not because of fluctuations around a Taylor rule, but rather because of persistently exposure to mostly interest rate lower than what a Taylor rule would suggest.

Interesting to take from this chart is that when we use inflation and output-gap values for the euro average we see that the average of absolute deviation from a Taylor rule is 1,98 %. This is because the ECB conducted a monetary policy with rates lower than the Taylor-rule would

[7] I have used the ECB-rate at the end of each year, and annual output gap values. All these data are included in the attachments.
[8] The table results are calculated with output gap and inflation-values from Eurostat. Parameter values used: natural rate of interest = 2 % and inflation target = 2 %.

predict even when we use euro-average values of inflation and the output-gap (as will be shown in figure 13).

Some of the deviation you see in figure 12 is because of the Taylor rule predicting negative rates. Until 2009 a Taylor rule predicts only positive interest rates for all EMU-members. In 2009 a Taylor rule predicted negative rates for several countries, and Ireland and Greece also had prediction of negative rates later.

Table 1 Predicted negative Taylor rates in the crisis years

Germany	-0,12(2009)
Ireland	-0,53 (2009), -4,34(2010), -0,52(2012)
Greece	-4,5(2012)
Spain	-1,24(2009)
France	-0,21(2009)
Portugal	-1,90(2009)

For Ireland the total deviation in figure 12 show an average deviation of 6,27 , approximately 0,96 of this is due to the Taylor rule predicting negative values. The deviation caused by a prediction of negative rates would have been present even for a national central bank able to conduct its own policy.

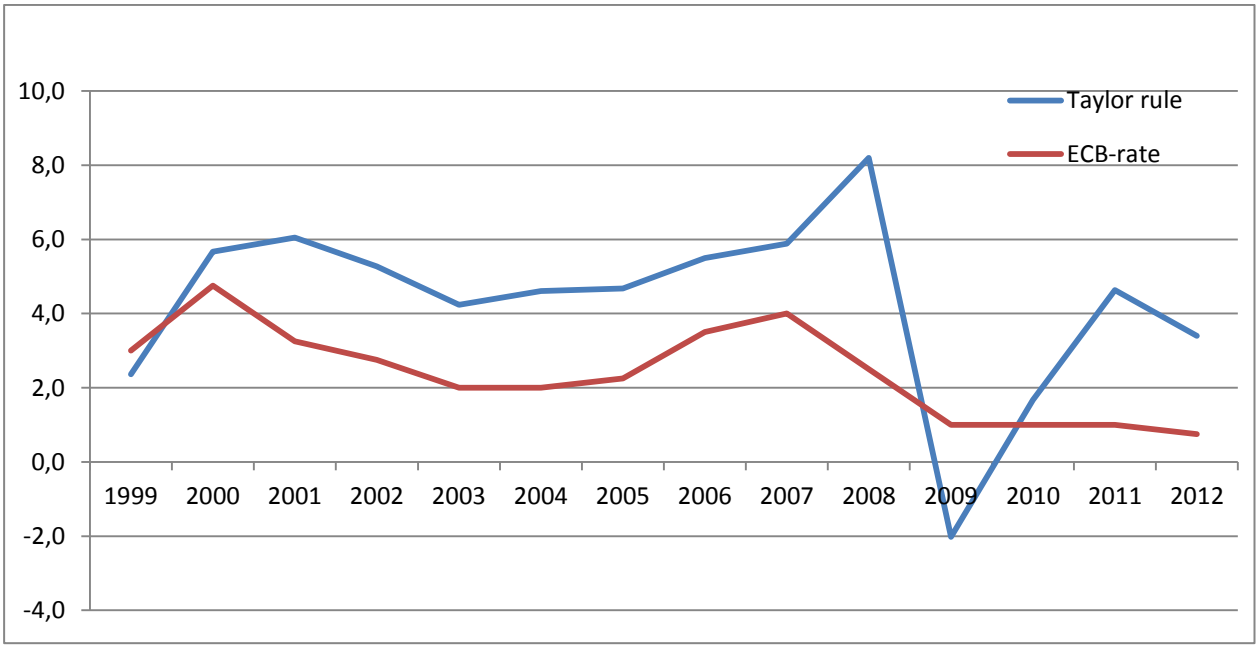
Whether the deviations are because of fluctuations around a Taylor-rule or not could be addressed by comparing the average of absolute deviations to simple average deviations. If the average of absolute deviation from a Taylor-rule is because of steady fluctuations above and below, the simple average would be close to zero. The results you can see in the table below. Numbers for Netherlands show 2,07 % average deviation for both absolute and simple average. This means they have been exposed consistently to an ECB-rate lower than what a Taylor-rule would predict for the whole period 1999-2012. A country like Ireland has a much lower simple average than absolute because before 2008 they needed higher key rates, and after 2008 lower key rates than what was set by the ECB.

Table 2 – Average deviation and average of absolute deviation

	Euro	Bel	Ger	Ire	Gre	Sp	Fr	Ital	Loux	Neth	Aus	Port	Fin
Average of absolute deviation	1,98	2,21	1,45	6,27	3,77	2,95	1,85	2,37	3,32	2,07	1,96	2,89	2,01
Simple average deviation	1,79	2,06	0,85	3,96	3,02	2,58	1,6	2,23	3,16	2,07	1,78	2,47	1,91

So how much of the deviation is because of a country having different economic performance from the EMU-core and how much is just due to ECBs deviation from the rule? Figure 13 is a chart showing that compared to the Taylor-rule; the ECB-rate has been lower in almost all years since 1999, except after the financial crash when desired interest rates were below the zero-lower-bound. Here I have used average values for inflation and output gap in the whole EMU-area. This chart could make one capable of arguing for the ECB conducting too loose policies the last decade, at least if we assume a Taylor-rule predicted rate is optimal.

Figure 13 - ECB key policy rate compared to Taylor rule - 1999-2012

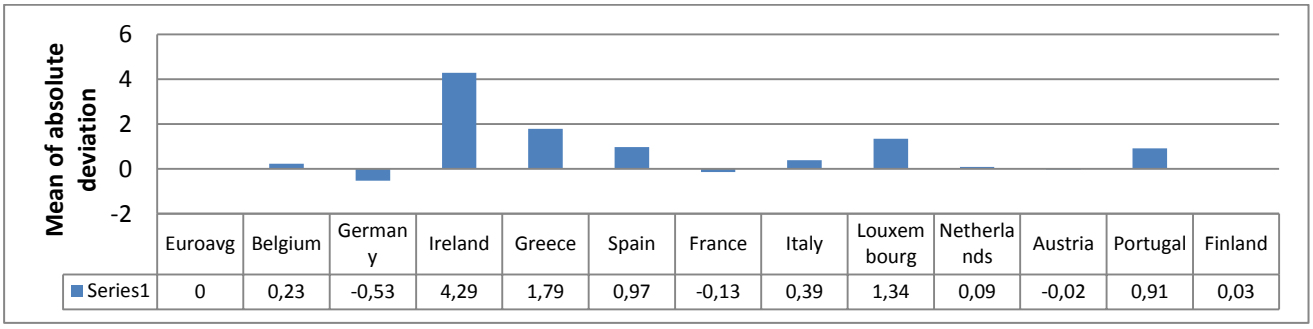


Source: Eurostat and own calculations.

If we take the ECBs average of absolute deviation from the Taylor rule of 1,98 % into account we can say something of which countries that have had economic activity higher or lower than what the ECB has defined as the average EMU-values. This is done by subtracting ECBs own average of absolute deviation from all the specific countries' average - resulting in much lower deviation for all countries. We would expect the deviation to be close to zero if the

country had average economic conditions close to the core of Europe, hence great deviations is an approximation to a countries' degree of asymmetry, and a measure of how ill-suited the nominal interest rate became for some countries.

Figure 14 - Deviation from Taylor-rule subtracting ECBs own deviation from the rule - 1999-2012

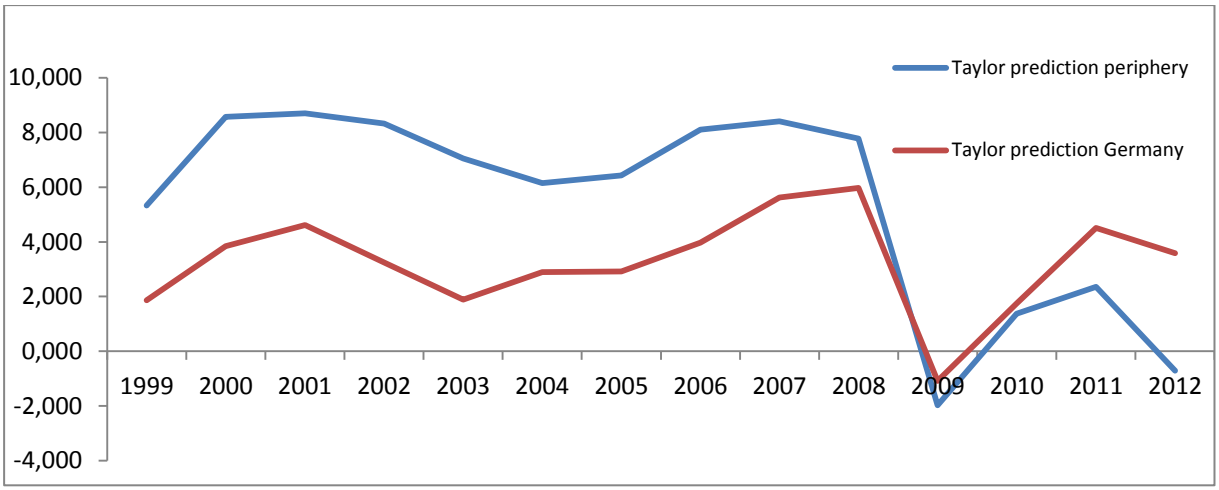


	Euroavg	Belgium	Germany	Ireland	Greece	Spain	France	Italy	Louxembourg	Netherlands	Austria	Portugal	Finland
Series1	0	0,23	-0,53	4,29	1,79	0,97	-0,13	0,39	1,34	0,09	-0,02	0,91	0,03

Source: Eurostat and own calculations.

Countries like Germany, France and Austria have actually had average deviations from a Taylor rule lower than what is the case for euro-average values, implying that they have been some of the countries which have been exposed to the most suited monetary policy in the period 1999-2012. Also countries like Belgium, Netherlands, Austria and Finland look like they have had economic activity close to the Euro-average. While countries like Ireland, Greece, Spain, Portugal, Italy (often referred to as the GIIPS-countries) and Luxembourg, experienced rates far from what a Taylor rule would suggest and especially before 2008 a too loose monetary policy, mostly because of their adverse economic performance from the core. This implies how the monetary policy of the ECB became particularly ill-suited for some countries in the *periphery*. This reasoning can be backed up if we look at a chart (figure 15) showing the difference between Taylor-rule predictions for the PIGS-countries (without Italy) compared to Germany. Here I have calculated the average prediction for the four countries in the periphery and compared them to predictions for Germany.

Figure 15 - Difference in predicted rate using a Taylor-rule for Germany and the GIPS-countries - 1999-2012

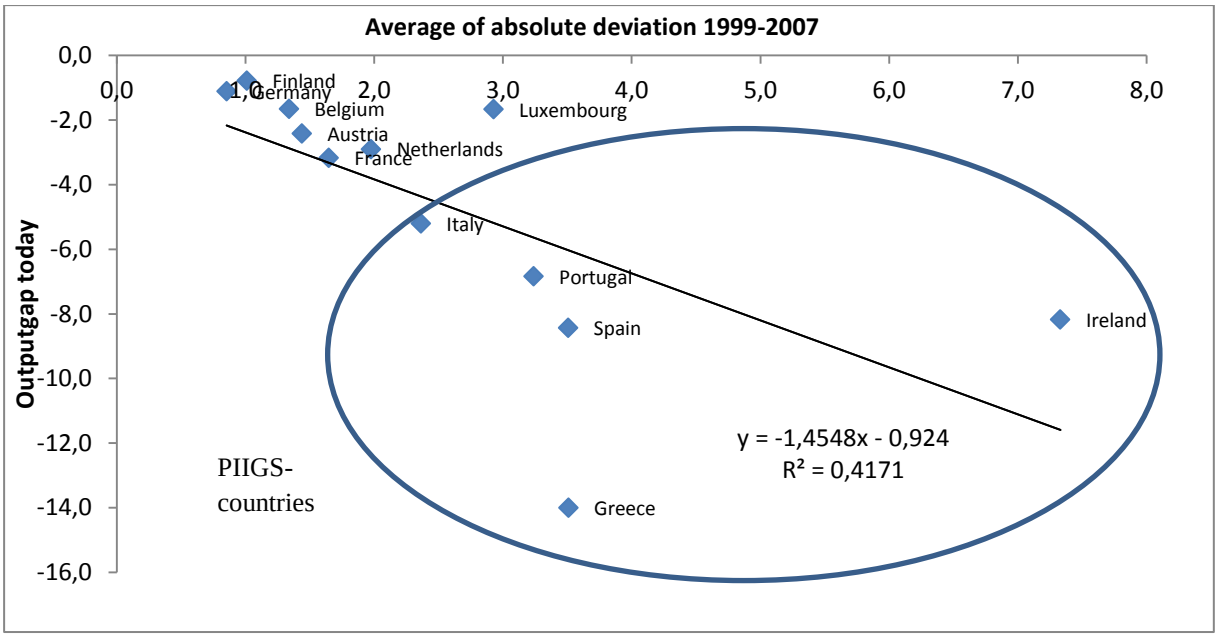


Source: Eurostat and own calculations

You might expect the trouble coming directly to those having largest difference from the core, but important to keep in mind here is that the level of flexibility and automatic stabilizers also plays a role. A higher labor mobility and wage flexibility could make a country more capable of handling a less suited monetary policy.

To give an overview of the relationship between deviation from a Taylor rule and the economic performance today I have, in figure 16, plotted average deviation from a Taylor-rule pre-crisis years (1999-2007) together with the output gap today. The PIIGS countries are situated close to each other. Though, it is important to keep in mind that correlation does not imply causation, but this chart nevertheless show a relation between deviation from a Taylor-rule and the negative output-gap today. Of course, directly you could argue that the negative output-gaps you see today is a result of the austerity measures in these countries, but then on the other hand, these austerity measures you could argue is a result of excessive borrowing due to low borrowing costs in the years before the financial crash, namely the non-suited low key rates set by the ECB.

Figure 16 - Trend between deviation from Taylor-rule 1999-2007 and output-gap in 2012



Source: Eurostat and own calculations

This chart serves the purpose of motivating my next chapter about Ireland. In this chapter I will seek to explore more specifically their relationship between ill-suited low interest rates in the years leading up to the crisis and the bad economic performance in 2008-2012.

Some remarks are though worth mentioning about this figure. All PIIGS-countries in the oval are to the right of all the others except Luxembourg, which is just a city state and hardly comparable. The slope of the trend line is determined by the positions of Ireland and Greece relative to the large group in the upper left corner. Hence, the difference between Ireland and Greece means that the variance on the slope estimator must be large with a low R-squared of 0,4171.

Greece has a huge negative output gap today, but deviates excessively from the trend line because it has not had a deviation from the Taylor-rule as high as the negative output gap today would imply. Here the austerity measures might have amplified their recession. Also Ireland stands out because they have had a deviation from the Taylor-rule that would imply an even more negative output gap today, but have managed a recovery better than most PIIGS-countries.

A caveat to keep in mind in the discussion in this chapter is the possibility that the deviation from the Taylor rule is a result of the natural real interest rate actually being lower than 2 %.

The discussion of the right value for this parameter is outside the scope of my thesis, but should be problematized to avoid too easy and quick conclusions. See the publication *'The natural rate of interest and the output gap in the euro: a joint estimation '*(Garnier and Wilhelmsen 2009).

As can be understood from this chapter many of the EMU-countries had economic performance and indicators that differed severely from the rest. To further investigate the relationship between ill-suited monetary policy and the problems today I will look more closely into one particular country, Ireland.

6 A closer look at Ireland

The Irish economy is story of an economy that flew high, and fell deep, housing investments that exploded alongside their prices, and economic activity which deviated heavily from the core of the EMU. They are an example of an economy were the divergence from the EMU maybe became too big to tackle a monetary policy most suitable for the core of the currency zone.

This section seeks to explore the relationship between Ireland's economic performance since 1999 and the ill-suited monetary policy set by the ECB. I do not prove any causal mechanisms, but rather generally address how severely different the economic indicators was for Ireland compared to the rest of the EMU.

The adverse economic performance

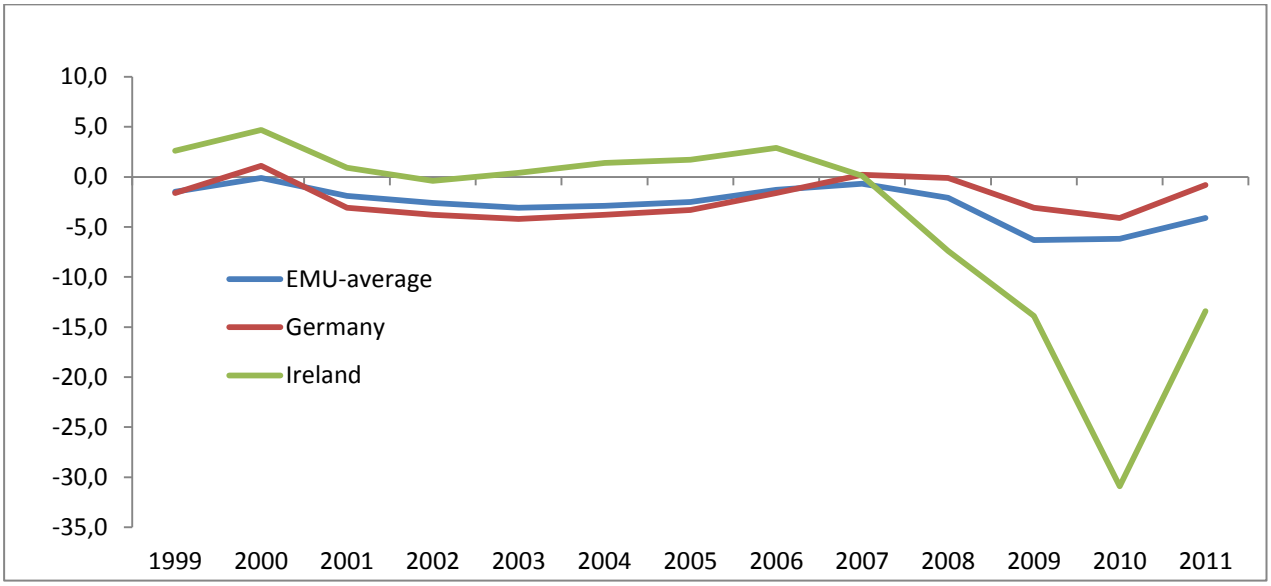
Asymmetric shocks happen when specific countries within a monetary union are struck by shocks unique for their region. There could also be asymmetric economic activity, if a country has a much higher growth rate than others not specifically deriving from shocks. Ireland is especially interesting to look at in connection to this because they diverged from the EMU-core more than any other country. So how has the Irish economy performed since they joined the EMU in 1999?

Figure 17 - Irish and Euro-area output-gap 1999-2014

Source: Eurostat

Ireland experienced economic growth way above the euro area average in the years after the creation of the monetary union. Economic growth was one of the highest in Europe, real disposable income rose dramatically, and housing prices accelerated. The difference in the output-gap you see in figure 17 above shows divergences to an extent that made a similar monetary policy unlikely to fit both. Ireland was already growing faster than the rest of Europe when they joined the EMU (marked with a vertical line), and the divergence just increased in the years that followed. When the financial crash struck the world economy Ireland was hit harder than many of its neighbors, and like most of the other European countries the government borrowed excessively to finance government spending, and public debt increased heavily (see figure 18), but as you can see the Irish debt increased in a much larger and different sense than both the average in the EMU and Germany.

Figure 18 - Government deficit/surplus - % of GDP - EMU, Germany and Ireland



Source: Oecd

While a country like Germany increased their public debt in much smaller and tolerable amount, the Irish debt increased severely reaching a problematic level far away from the 3 % of GDP-rule mentioned in the treaty on the convergence criteria. The excessive increase in government deficit you see from 2007-2008 was driven by the Irish governments decision to help out domestic banks with asset, deposit and bond guarantee schemes. When the housing bubble in Ireland burst in mid-2007 their banks suffered major financial losses. The government then stepped massively in with different bank guarantee measures. The Irish government used a total of 198,1 % (Levy and Schich, 2010, p.40) of GDP in 2008 to provide financial support measures to domestic banks - clearly the highest amount among the

European states. These guarantee measures together with pro-cyclical fiscal policy lead to a massive increase in government deficit.

First, the debt seemed tolerable for Ireland, but from the autumn of 2010, investors realized the possibility of sovereign debt default and Ireland was closed out of sovereign bond markets. The government was in need of "bail-out" from the EU, ECB and IMF (Troika) to finance their large public debt obligations, and help was provided conditioning on austerity measures to calm markets and reduce the chance of a sovereign debt default.

Ireland is an interesting case because the deviations from the euro core were so dramatic, and the problems today are so apparent. It is of course problematic to conclude causation between the ill-suited policy and the problems today, but stating it has been partly responsible is not a radical hypothesis.

Although Ireland has a relatively flexible labor market, measured by the World Bank Labor market flexibility index (Cuñat and Melitz 2011), compared to rest of Europe, the divergence probably became too large to be dealt with by automatic stabilizers. Especially their housing sector experienced growth excessively different (figure 23) from to core of the EMU.

6.1 Ireland's deviation from a Taylor rule

You see in the chart below (figure 19) that Ireland was exposed to key policy rates much lower than optimal by a Taylor-rule. These low rates resulted in lax lending standards and easy access to cheap credit, and excessive borrowing to finance investment in an economy already above full resource utilization. In figure 19 I have drawn a chart showing the difference between an interest rate predicted by a Taylor-rule and the ECB-rate. Showing the *de facto* ECB-rate much lower than what was optimal by this rule for Ireland.

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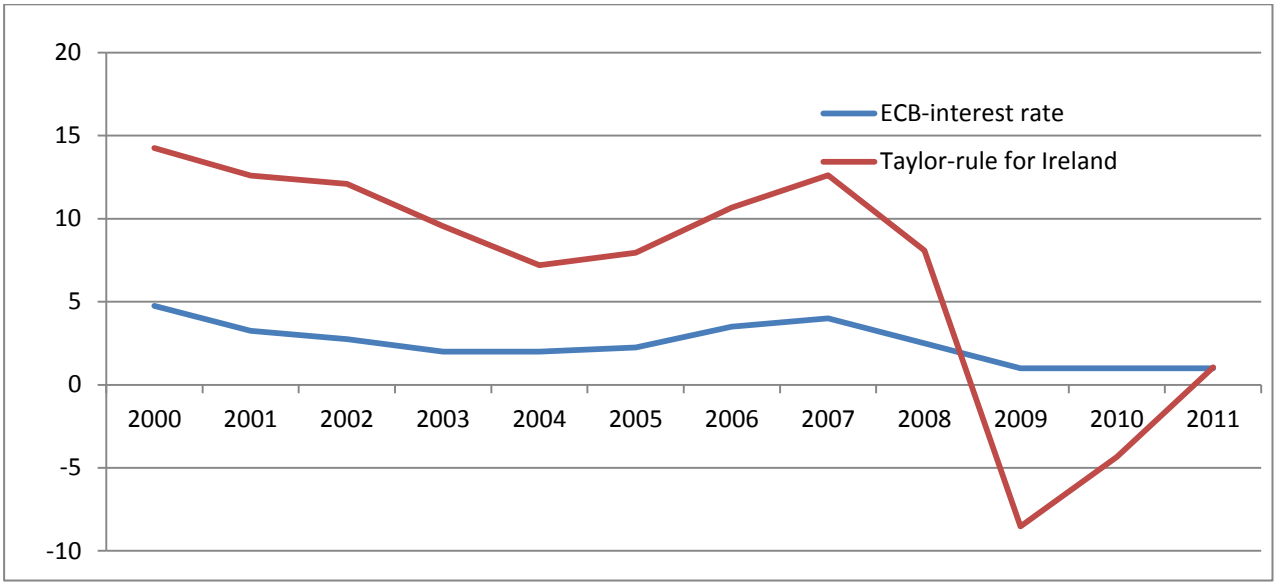
Figure 19 - Irish optimal rate vs. ECB rate 2000-2011

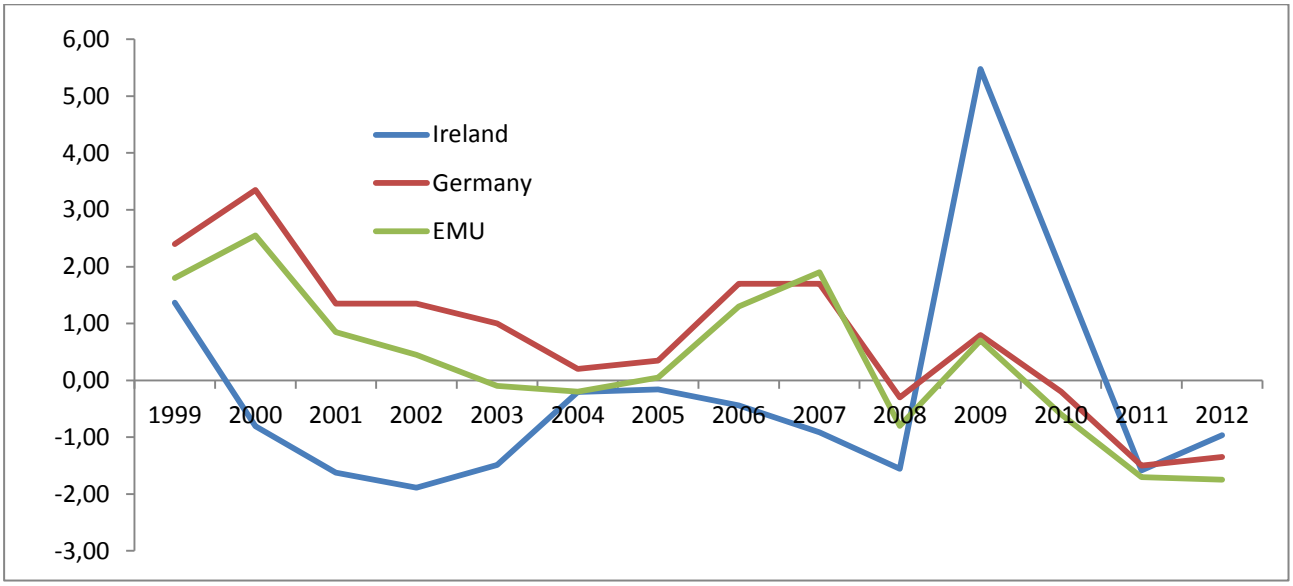


Source: Eurostat and own calculations.

In all years since introduction to the EMU and up to 2008 Ireland was exposed to a rate lower than optimal according to a Taylor-rule. This chart shows a country which experienced monetary policy becoming particularly ill-suited because of their divergence from the core. The key policy rates suggested by a Taylor-rule should have been higher in all the years since the introduction of the euro and up to autumn 2008. After the financial crisis in 2008 the preferred rate was much lower than the ECB-rate, and called for impossible negative rates. You could of course problematize the optimality of an interest rate found by a Taylor-rule, and some national central banks would not have followed such a rule exactly anyway(at least with negative rates), but it is hard to think of a national monetary policy that would have deviated like in this case. In this manner you could argue that Ireland suffered from being unable to conduct their own monetary policy, independent of the reason for their divergence.

Ireland had higher inflation than most countries and so the real rate was severely lower than the nominal rate. The difference in real rates you can see in figure 20 below where I have included the German and average EMU-real rates. Ireland had negative real rates almost the whole period from the start of the EMU until 2008, and this happened at the same time as economic activity already was way above full resource utilization.

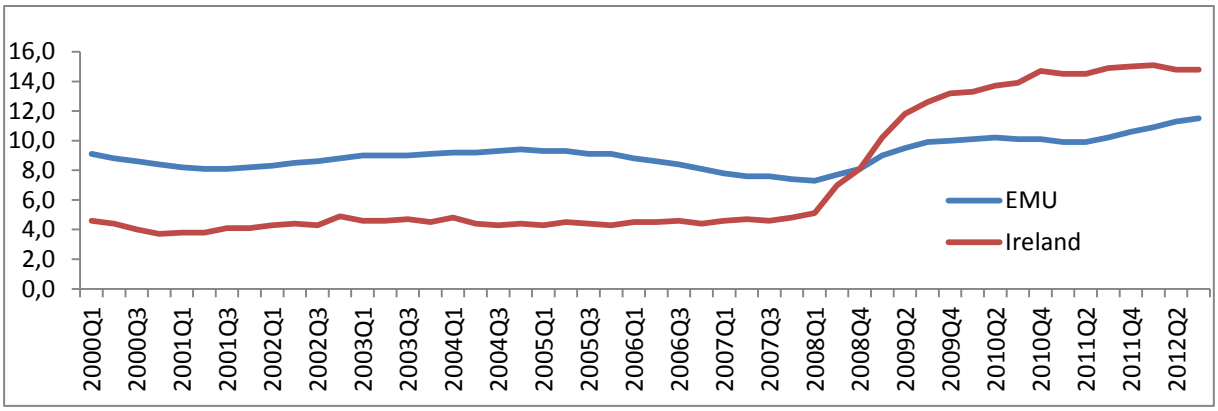
Figure 20 - Irish, German and EMU real-rates - 1999-2012



Source: Eurostat and own calculations.

Another chart which emphasizes the asymmetry between Ireland and the EMU can be made looking at the unemployment rates. While the average unemployment rate in Europe has not changed that much during the last year's economic distress, the Irish rates were well below euro average until 2008 with a low of close to 4 % right before the crisis, and accelerated to reach a level close to 14 % in the start of 2011.

Figure 21 - EMU and Irish unemployment rates - 2000-2012



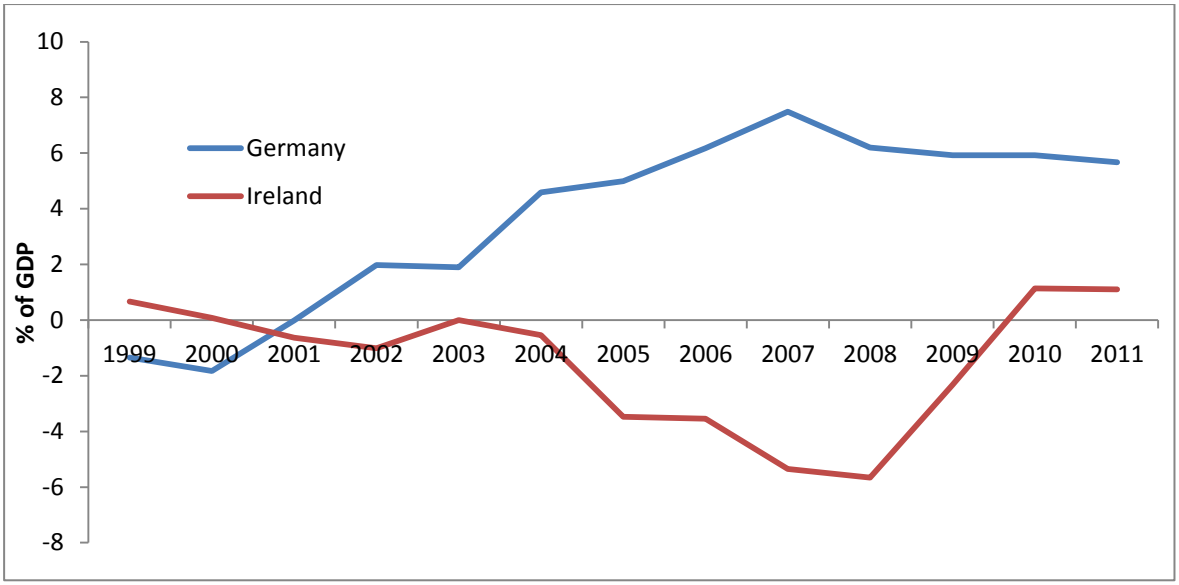
Source: Eurostat

6.2 Irelands current account deterioration

In chapter 2 on OCA-theory I mentioned how different growth rates could become a problem if it deteriorated the fast growing countries trade account. This is close to what happened in the case of Ireland vs. Germany. Ireland experienced trade account deficit when the country

grew faster than the core of the EMU, while a country like Germany had an excessive trade account surplus. Ireland's high growth led to increased demand for foreign goods (imports) while export demand did not change accordingly. This trend was difficult to turn, and did not before the growth pace seriously slowed down. When the Irish CA reached a surplus in 2010 the economy had then been contracting since autumn 2008.

Figure 22 - German and Irish current account - 1999-2011

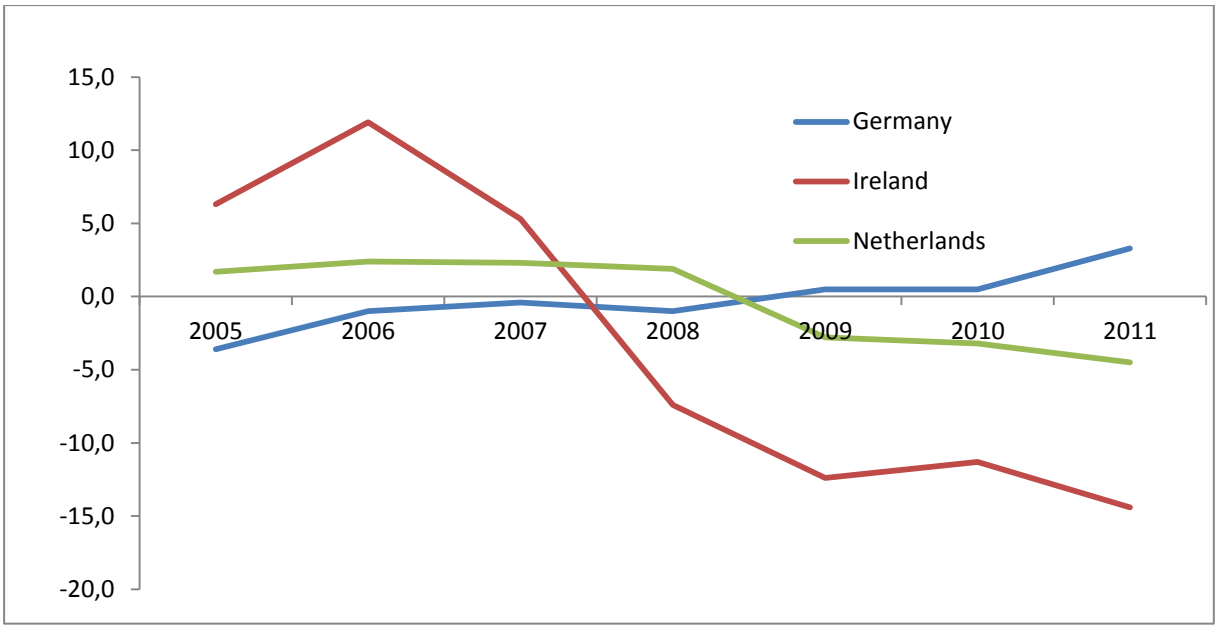


Source: Eurostat

6.3 Housing bubble

Alongside prosperous economic growth the Irish housing market prices rose dramatically from the millennium-shift and up to the financial crash in 2008. Prices reached its peak in 2007 and bottom low by July 2011, resulting in a total decline of 43 % (Eurostat) - nothing less than a housing bubble that burst (see figure 23). I have included the development of the German prices to give a perception of the divergence within the EMU.

Figure 23 - Real house prices - % change from previous year - Germany, Netherlands and Ireland – 2005-2011



Source: OECD

This chart gives an insight into the large differences between three countries within the currency zone. Germany with one the lowest growth rates pre 2008 and the highest growth after 2008. Netherlands I have included because they represent a more average path for the countries in the EMU, and Ireland with a bubble that burst from around mid 2007.

Housing and construction bubbles are highly correlated in nature, and create self-reinforcing mechanisms, often difficult to distinguish what causes what. When housing prices increase, it is more profitable to go into construction, and the constructers also needs housing, which might even increase demand further. On the side of those looking for a house, it's profitable to invest in housing as long as the prices grow, and the banks are not as reluctant to give mortgages with security in the property as long as the value of the houses keeps growing. According to economic theory house prices increase when demand increase and the supply do no react accordingly to offset the new demand. The complexity with housing is that the supply response will always take time because building a house is a time-consuming activity, making property prices almost always increasing when demand increases. Irish housing construction increased heavily as a response to the increased demand, and the supply response was clearly evident, but obviously not enough to stop the bubble from expanding and prices to accelerate dramatically.

What role did low interest rates play in creating the Irish housing bubble?

I have not identified any causal channel between low interest rates and the Irish housing bubble, but at least with economic theory you could argue for causation between low real rates and increased growth in housing prices. How do low key rates increase demand for housing? The transmission channel could be described trivially; low interest rates make credit and borrowing cheap, access to mortgage easier, and so demand for housing investment increases, so the low rates could increase housing prices. Also in Taylor's paper (2009) he argues for similar causal relationship, although for the US housing market, in a subchapter called 'No Boom, No Bust', namely the relationship between the low key-rates set by the central bank and the bubble that developed in the housing market. He argues that the housing bubble could have been avoided had the Taylor-rule been followed

The idiosyncratic nature of the Irish housing price development and the fact that housing prices is not an explicit concern for the central bank made interventions to account for this specific bubble problematic to deal with for a monetary policy that was supposed to be optimal for the whole currency zone.

Can we point to other explanations to describe Ireland's divergent growth pace? One hypothesis is Ireland's attractiveness as destination for foreign direct investments (FDI). Many non-European firms used Ireland as an entrance to the European internal market after the creation of the EMU. Ireland as the only English speaking country in the EMU, together with low corporate tax-rates made Ireland particularly popular for foreign investment. This made investments in Ireland more attractive than other EMU-countries. Unregulated lending standards, and absence of supervision of the financial institutions, could also be argued to have had an amplifying effect on the property bubble and overinvestment, but not to have been the driving forces.

6.4 Could we blame the loose monetary policy?

Independent of whether too low and ill-suited interest rates were the driving force or not, you could argue that the strong growth should have been slowed down by contractive monetary policy. Something that could have decreased the economic recession and contributed to a soft(er) landing, but was difficult because of Ireland's divergence from the core of the EMU.

It is natural that ‘one size do not fit all’ in a monetary union, but Ireland can be argued to have been in a situation where the monetary policy became particularly ill-suited. Also when the automatic stabilizers to account for these asymmetries did not work satisfyingly to make Ireland converge back to euro-average economic standards their divergence from the core made them particularly vulnerable to loose monetary policy. Independent of the cause of Irelands problems their divergence from the core of the EMU was much higher than established OCA-theory find optimal, and maybe too high for Irelands own good. The divergence from the core was apparent looking at several different economic indicators, something that made the membership to a monetary union problematic. The Irish example might also be used as a counter-argument to those that argue a currency union is endogenous on the ex-ante criteria in OCA-theory.

The financial crisis can be seen as an example of a big common shock to the EMU - a shock that made it difficult to identify local shocks in that period. The vulnerability was different, and Ireland seemed to be one of the countries that were hardest hit when the shock occurred, perhaps because monetary policy did not fit local circumstances in earlier periods. Ill-suited monetary policy plus the Irish government’s decision to help out troubled banks might be seen as a two contributing factors for the Irish problems that materialized in the wake of the financial crisis.

The Irish economic performance deviated heavily from the core of Europe in the years leading up to the financial crisis and called for policy different from the rest of the union. In the Irish case I would argue that staying outside a currency union could have avoided some of Ireland’s problems, at least the degree. A national Irish central bank could of course have deviated from a Taylor rule themselves, but it is hard to think of a scenario where the average of absolute deviations would have been as large as - 6,27 % in 1999-2012, and even larger before the crisis in 2008 with 7,3 % in 1999-2007.

7 Netherlands vs. Sweden

A pressing question when we study the EMU is how those that have stood outside (voluntarily or involuntarily) of the currency union have performed. So in this section I will try to discuss the nature of a monetary union using an inside/outside-the monetary union-approach. Some of the countries which are members of the EU, but not the EMU were not able to be part of the currency union because they did not fulfill the convergence criteria, but some have decided not to be a part - like Sweden. In this section I will try to shed some light upon the question whether it has been advantageous to stay outside the EMU or not during the last year's economic problems

To discuss advantages/disadvantages of staying within a currency union I will focus on how two countries – one inside the EMU and one outside – have developed the last years.

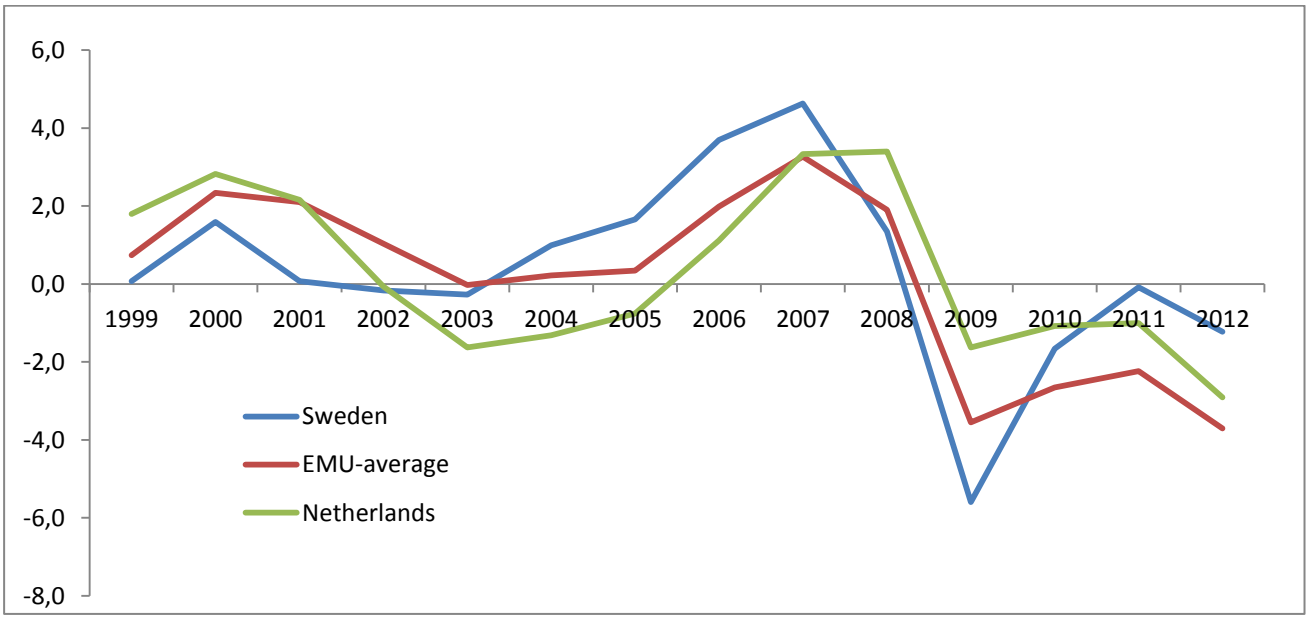
I will study two countries with similarly economic structure- Netherlands and Sweden, but with different monetary policy regimes. Do they make a good comparison? Numbers from 2011 show they rank close in GDP per head, Sweden with 35 151 $ and Netherlands with 37 119 $ (Eurostat). They are both small countries compared to the whole union, consisting of approximately 5 % (Netherlands) and 2, 85 % (Sweden) (Eurostat) of the population in the EMU. Sweden might have more natural resources than the Dutch', but both countries have a large export oriented sector making them vulnerable to shocks in foreign demand. They can both be characterized as small open economies. They are obviously not a perfect match for comparison, and assuming both economies would have developed similarly with the same monetary regime is of course not the case. Though, for the discussion purposes I find the comparison-approach helpful as a point of departure. Sweden has a national central bank, while Netherlands is exposed to the monetary policy conducted by the ECB, which is based on the whole Eurozone's economic condition. I will look at their economic development the last years and try to discuss if the differences, though small, in output gap stems from Sweden being outside the EMU or whether it has to do with fiscal policy.

First, let us recap what OCA-theory says. The obvious advantage Sweden has is that they can conduct their own monetary policy when a shock occurs, while Netherlands has to be exposed to a monetary policy suitable for the whole union. You could argue that the Swedish central bank will not set rates independent from the ECB because they will try to keep the exchange rate stable, but at least the Swedish opportunity for different key interest rates is present,

though formally the Riksbank has an inflation target. Implicitly this mean they can boost growth more than ECB by lowering rates further down, which also might lead to a depreciation of their currency. At least if we assume uncovered interest rate parity with perfect capital mobility, interest rate differences between ECB and the Swedish Riksbank should lead to changes in the exchange rate. Though, as we will see later different mechanisms than UIP drive exchange rate differences in economic distress, especially between a small and a large currency. This may imply the opportunity of controlled devaluations is not as present as classical OCA-theory would suggest for a country outside a currency union with a small currency.

Let us first look at our two countries economic performance. We study their output gaps from 1999-2012. In this period both countries were exposed to the financial crash in 2008 and later the materialization of the euro-debt crisis from 2010. The bankruptcy of Lehman Brothers and general financial collapse in autumn 2008 was felt clearly by all economies in the west, and Netherlands and Sweden were no exceptions. So how did the two countries respond?

Figure 24 - Output-gap Netherlands and Sweden- 1999-2012



Source: Eurostat

The chart above shows how both Swedish and the Dutch output-gap dropped from the autumn of 2008, and Sweden experienced an even more severe recession than both Netherlands and the EMU-average. From around 2010, when the problems caused by the financial crash decreased and their economies gained momentum Sweden had a stronger recovery than the Netherlands. Today Sweden has a less negative output gap than the Netherlands.

Why was the contraction stronger in Sweden? And why did they manage to come back and perform better than Netherlands from around January 2010? Can their different economic performance be related to their different monetary policy regimes? These are the questions I will try to assess in this section.

7.1 Why was the contraction in Sweden stronger than in the Netherlands?

Sweden went into a larger contraction than both Netherlands and the EMU-average after the negative demand shock in 2008. One explanation to Sweden's large contraction and later recovery could be that before the shock in 2008, they had a higher output gap than Europe and therefore a harder landing. If we study business cycles this phenomenon is observed many times through history, that a stronger boom-like economic expansion makes the following contraction stronger. This phenomenon could be explained in several ways, but one hypothesis is the *financial accelerator (Bernanke, Gertler et al. 1999)*[9] which explain how macroeconomic fluctuations are amplified and propagated by developments in the credit markets. If we follow such reasoning (stronger expansion, harder landing), we might also explain Sweden's strong recovery with the size of their contraction, though this is more intuitive because an economy with a large negative output-gap has more unfulfilled potential to regain. If the no-boom-no-bust story is true, the difference in Sweden's and the Dutch' economic fluctuations do not stem from different monetary policy regimes, but rather a general economic phenomenon. The story of Ireland might give another argument for the truthfulness of the no-boom-no-bust hypothesis. They had the highest output-gap in Europe, and also the largest contraction.

7.2 Did the two central banks react differently?

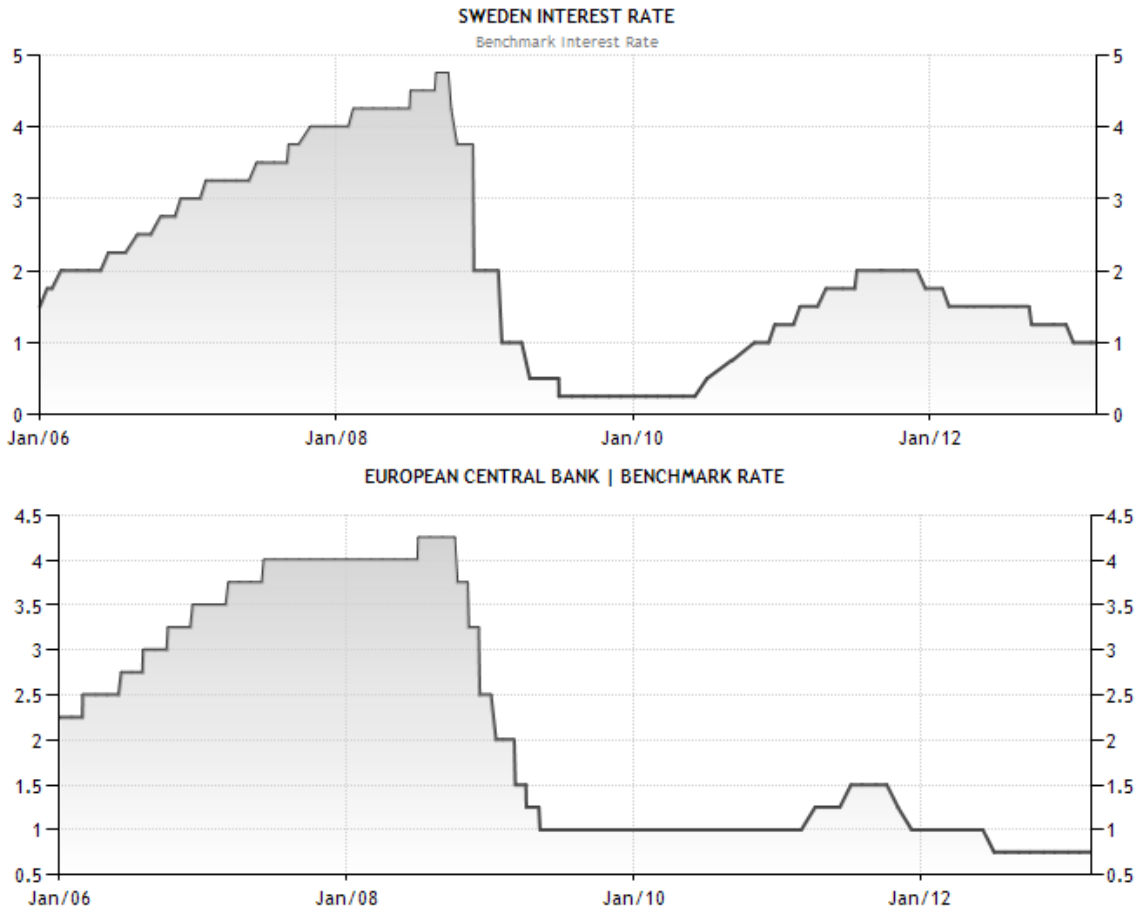
The opportunity for independent monetary policy is Sweden's main advantage outside the EMU. Did they use the advantage to conduct a more expansive policy?

[9] Firm's ability to borrow for investments is mainly decided through the market value of their net worth, which decides their collateral. With high economic growth, prices and asset values increase, increasing firm's possible collateral and ability to borrow for investments. Increased investments might lead to further increase in net worth, which lead to more collateral and even higher ability to borrow. This mechanism is called the *financial accelerator* because it might amplify macroeconomic business cycles.

Both central banks have inflation close to two percent as their main target, but stabilizing production and employment is also included in their objectives.

The two central banks policy is difficult to compare directly, since the ECB conducted policy by actively changing the rates on the MRO's, marginal lending facility and the deposit facility, while the Riksbank mainly used the repo-rate to adjust activity. We can not just look at their repo rates and conclude the one with the lowest repo rate has the most expansive monetary policy. In figure 25 I have included a chart showing the Swedish central bank rate at the top and the ECB MRO-rate below, and their response to the reduced demand and troubled banks since autumn 2008. At first both banks reacted similarly and by May 2009 the ECB had reduced their repo-rates to 1%, while the Riksbank rate stood at 0,5 %. The ECB never went lower than this and held the MRO at 1% until April 2011 when they increased rates to 1,25 %, but the trouble in 2008 called for more than just interest rate reductions in both regimes. Both the Riksbank and the ECB increased supply of liquidity to troubled financial institutions in the same period, which might have made the deposit rates more important. They provided cheap liquidity and set deposit rates low so that financial institutions would hopefully lend to each other and not deposit the money back were they came from. ECB's deposit rates was reduced to 0,25 % (the lowest level) in the same period as their repo rate was at 1 %. The Swedish Riksbank on the other hand lowered their key rate to first 0,5 % and later to 0,25 % by mid 2009. In the report on the decision to decrease rates to 0,5 % in April 2009 the Swedish Riksbank states that a further decrease by the ECB is expected, something that did not happen. Even though the ECB did not decrease their rates further the Swedish Riksbank decreased their key rate to 0,25 on a meeting in august 2009. Then deviating with 0,75 % from the ECB repo-rate. As the Swedish recovery progressed key rates were slowly raised between spring 2010 and late autumn 2011 to a level of 2 %.

Figure 25 - The Riksbank and ECB key interest rate setting - 2006-2012

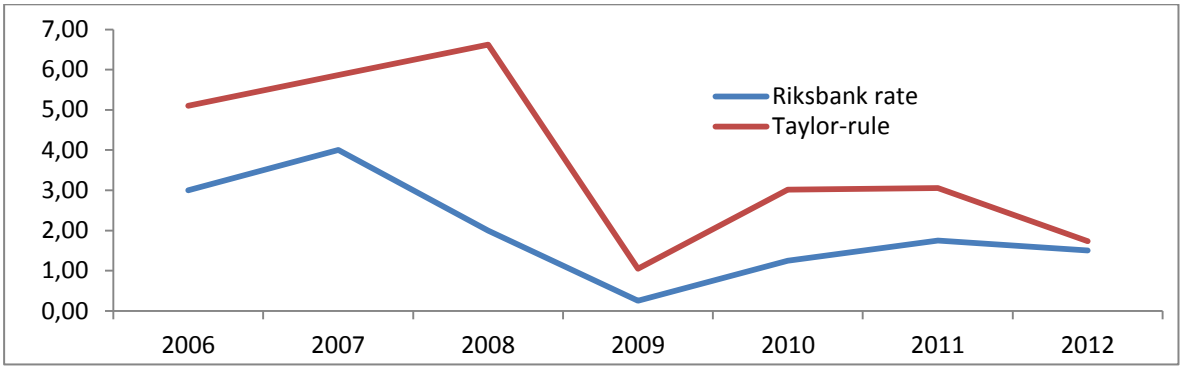


Source: Tradingeconomics.com

According to classical economic theory you might argue that general interest rate differences as in this case have two effects. First, lower rates by one country compared to another might boost growth stronger. Second, assuming perfect capital mobility, lower rates might make capital flow to the country with the highest rate, hence decreasing demand for the low-rate-currency which then depreciates.

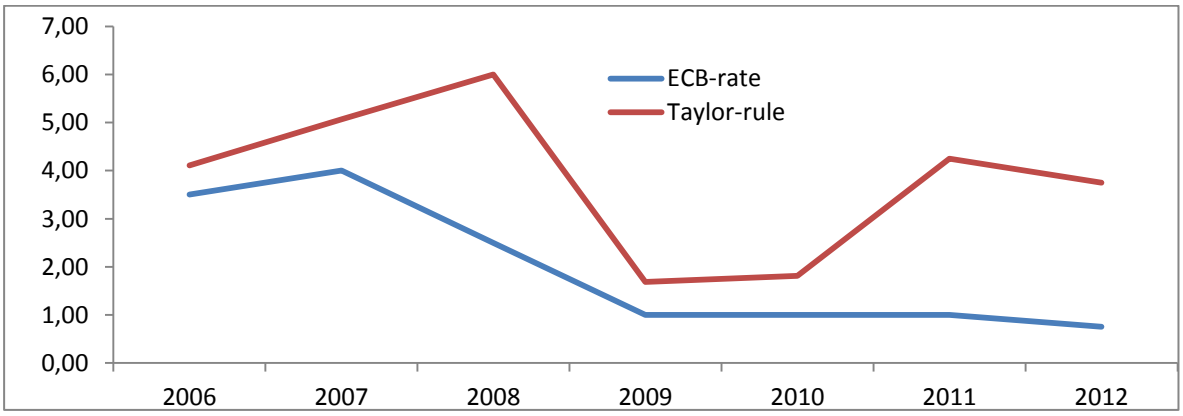
How were the different repo rates set compared to a Taylor rule? Below I have included charts showing Taylor rule predictions and the deviation from interest rate set by the two central banks in the crisis years. Up to 2010 they both seemed to have rates slightly expansive if we use the Taylor rule as point of departure. In the whole period we can see from the figures 26 and 27 both the Netherlands and Sweden were exposed to rates lower than what a Taylor-rule would predict

Figure 26 - Swedish deviation from Taylor-rule



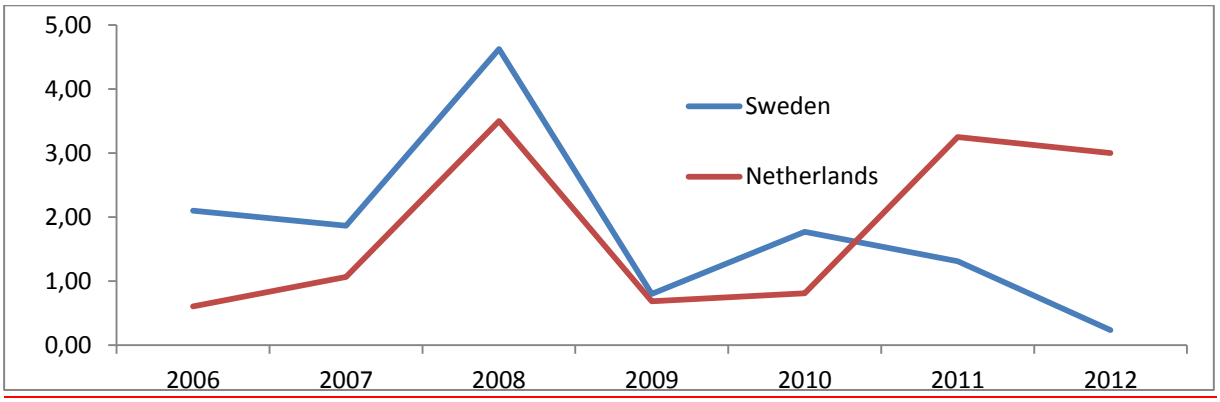
Source: Oecd and own calculations

Figure 27 - Dutch deviation from Taylor-rule



Source: Oecd and own calculations

Figure 28 - Swedish and Dutch deviation compared



Source: Oecd and own calculations.

In figure 28 one can see that the deviations are not severely different except from around mid 2010 when the deviation is higher for Netherlands. Actually it looks like Sweden have deviated more from a Taylor-type-rule in the period 2006-2010. From around 2010 the deviations are higher for Netherlands. A hypothesis then is that a national Dutch central bank

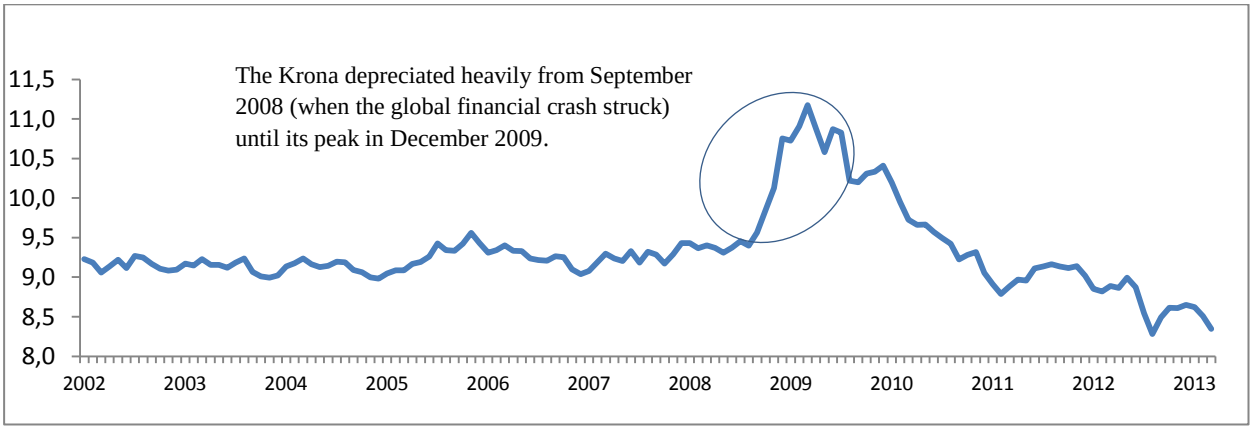
would have had higher repo-rates post 2010 and the monetary expansiveness would have been less than as a member of the EMU. So by looking at national indicators for the Dutch post 2010 you could argue they would have had less opportunity to reduce rates, ceteris paribus, if they were outside the EMU. A remark from this reasoning could be that it does not seem to have been a tighter than desired monetary policy that could explain the different development between Sweden and the Dutch post-2008.

7.3 Exchange rate movements

The other advantage Sweden had compared to Netherlands through the recession in 2008 was that they could depreciate their currency compared to the euro, and in this way give their export sector a boost. Though, as mentioned, formally the Swedish Central bank has an inflation target so you could argue the exchange rate is not interesting except for its impact on inflation.

Was reducing the price of the Krona a goal for the Swedish central bank? If we study reports from the Riksbank published after their interest rate meetings in the period 2008-2009 I do not find any direct comment stating that their interest rate decreases is motivated by devaluation of the Swedish Krona, though this could of course be an implicit goal not directly mentioned.

Figure 29 - Swedish kroner/euro - 2002-2013



Source: Eurostat.

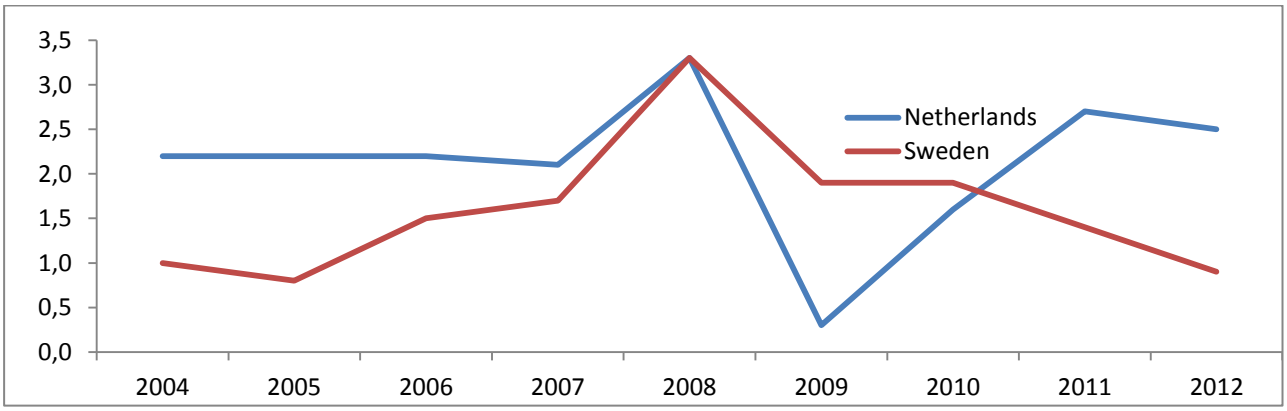
If we closely study the development of the Swedish krona compared to the euro it seems to have developed independently of the deviations (though small) between the interest rate set by the ECB and the Riksbank. So it looks as if the price of the Krona was outside the control

of the central bank anyway. This might be used to reason that as long as capital mobility is high, the exchange rate is, in the short run, decided by capital movements, and these can be independent of the interest rate differences. At least in economic environments like the case after autumn 2008 what seemed to drive the depreciation of the Swedish krona was expectations and the perception of currency-risk that led investors to sell Swedish kroner.

Even when assuming UIP would hold, it seems like the Riksbank's scope for an interest rate differential (lower than ECB) to devalue their currency was limited. When both central banks have already reduced their rates as much as both the ECB and Riksbank did as a response to the demand shock in 2008, the possibility for large interest rate differences to depreciate own currency is of limited availability. Admittedly the Riksbank had lower repo-rates than the ECB in the period from December 2008 until April 2011, but this deviation was only 0,75% at the most.

The weakening of the Swedish krona can be explained by two factors as I see it. First, because of it being a small currency. In economic distress small currencies like the Krona depreciate compared to larger currencies like the euro and the dollar. This is because investors want to put their money in larger (safer) and more liquid currencies. So the strong depreciation can not be explained by uncovered interest rate parity and different interest rates. The other explanation is the different inflation rates. In the period of the Krona depreciation Sweden had higher inflation rates than the EMU (figure 30).

Figure 30 - Inflation Netherlands vs Sweden – 2004-2012



Source: OECD

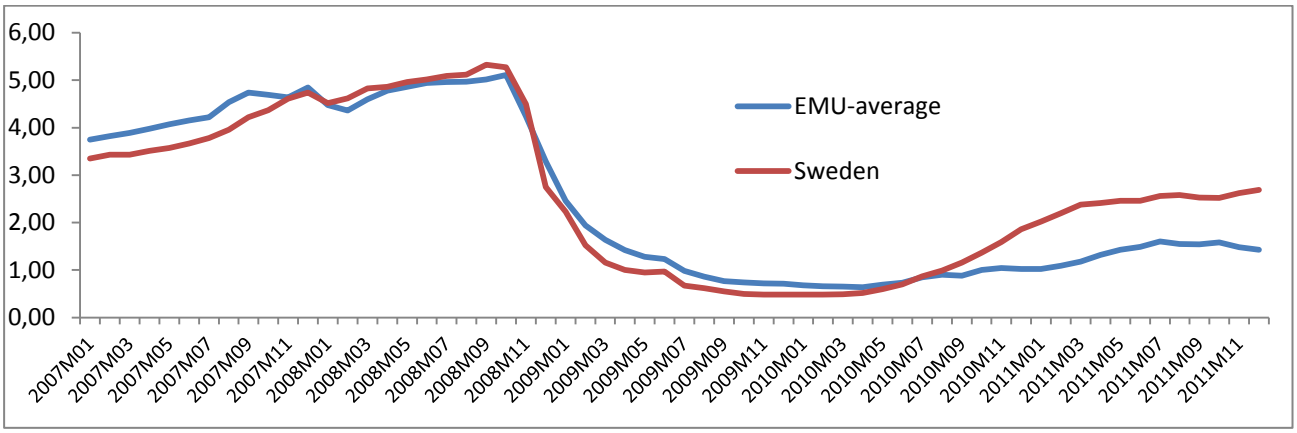
With floating exchange-rates, different inflation rates may cause a decreased demand for the currency with the highest inflation-rate, hence a depreciation of the Swedish krona. These two factors might have worked together to reduce the price of the Swedish currency, though the

flight from the Krona because of investors hunt for less risk looks to have been the strongest factor. It is difficult to quantify the advantage the weak Krona had on demand for Swedish goods, but at least we can say it was positive in sign, and it might have given Swedish export firms a small advantage compared to Dutch' and other European firms.

7.4 The situation in the financial sector

Let us look at economic policies independent of the EMU-membership. Did Swedish banks trouble more than banks in Europe after the economic downturn in 2008? Figure 31 show the 3-month money market rates in Sweden and the EMU. I assume these rates are a proxy for the public's perception of trust and robustness of the banks in the respective areas. A sudden acceleration of money-market rates would mean the public perceived the banks as less robust to stress, and liquidity flows and interbank lending could then slow down.

Figure 31 - Money market 3-months rates in EMU and Sweden - 2007-2012



Source: Eurostat

If these rates would have differed excessively it could have meant banks in either area were in larger troubles. If say rates in Sweden were much higher, it could mean the availability of credit was lower and this would have affected the economic activity. But as you can see these rates have been following the same path for several years. Indicating the banks in EMU and Sweden did not trouble at a large adverse degree.

Have the help provided to the domestic banks been different between these countries in the crisis years? In the whole Euro area governments stepped massively in to support the financial situation in their domestic banks after the financial crisis in 2008. Different government-guarantee schemes were used, these guarantees can be divided into three different categories

(Levy and Schich 2005), capital injections, asset guarantees and purchases to reduce banks' exposure to capital losses. These measures might have been what rescued some banks from defaulting. Was these measures provided at different degrees in Sweden and the Netherlands? Netherlands provided asset, deposit and bond guarantees to their banks, while the Swedish government did provide deposit and bond guarantees but not for assets (Levy and Schich, 2005, p. 39). As for financial support measures it looks like the Dutch provided larger amounts than the Swedish. They supported financial institutions with guarantees for a total of 33, 9 % of 2008 GDP, while Sweden used a total of 10, 9 % of GDP in 2008 (Levy and Schich, 2010, p. 40).

Looking at these numbers it looks like the government support to financial institutions was more profound in Netherlands than in Sweden, both in types of measures and amounts of GDP.

7.5 What about fiscal policy and government stimulus?

Can different degrees of fiscal stimulus explain the adverse recovery? In economic downturns a government can use fiscal policy to increase economic activity. A country can introduce Keynesian counter-cyclical economics, and second, letting domestic stabilizers like taxes and unemployment benefits work to dampen contractions. The fiscal policies in the EMU are not centralized, so here a country like The Netherlands can decide on their policy independent of the other countries. So what do the numbers on fiscal stimulus say?
For this purpose I utilize a report from the European Trade union institute from 2009 (Watt and Nikolova 2009).

Table 2 - Fiscal stimulus in the crisis years - Netherlands and Sweden

	Netherlands	Sweden	EU average[10]
Overall size of fiscal package (% of GDP)	1	2,4	1,70
2009	0,45	1,25	0,99
2010[11]	0,51	1,15	0,61

Source: (Watt and Nikolova, 2009, p.11-12)

From the table it is clear that Sweden conducted more fiscal stimulus after the financial crisis in 2008. This could be because of their stronger fiscal position than the Netherlands (see figure 32). Independent of the causes, a stronger countercyclical policy by the Swedish government is one hypothesis that could explain why their recovery was stronger than both the Dutch' and the European average.

In OECDs survey on the Swedish economy from 2011 (OECD 2011) they write on their fiscal policy: " ..a large fiscal surplus at the onset of the crisis allowed Sweden to let automatic stabilizers play their role in full and to introduce discretionary stimulus without threatening fiscal sustainability". As you can see from figure 32, Sweden's fiscal position has been and still is strong compared to both the Dutch and EU15-average. This might have done Sweden more able to let fiscal stabilizers play a role in the recovery to a larger extent than the Netherlands. In such a case this is independent of Sweden's role outside the EMU, and something the Dutch maybe could have been able to use even as a member of the currency union if the government financial balances had been better. On the other hand it should be added that the Dutch fiscal consolidation did not really start before September 2012 (OECD 2012) when their consolidation package was agreed on, introducing structural reforms on areas such as pensions, the housing market and the labor market, which would be expected to have a dampening effect. So you could argue that even though the Dutch had to introduce fiscal consolidation to a larger extent than Sweden, the real tightening was introduced too late to explain adverse development in the time before the consolidation package was agreed upon.

[10] Simple average, not weighted by country size.
[11] The numbers for 2010 is what was foreseen in May 2010.

Figure 32 - General government financial balances – Netherlands, Sweden and EU15

[12]Source: Oecd

What can we conclude?

The collapse in the world economy in autumn 2008 was felt as a negative demand shock to both Sweden and the Netherlands. Sweden first went into a more severe recession, but came back stronger than the Netherlands, and today they have a less negative output gap. Can we explain Sweden's strong recovery with their role outside the EMU?

The Swedish monetary policy was maybe slightly more expansive than what the ECB conducted. It is difficult to quantify exactly what impact this had on the Swedish recovery, but at least the rates were lower then what the Dutch were exposed to and might have given them an advantage with stronger economic stimulation. If Sweden had been a part of the EMU much probably they would have been exposed to the monetary policy that the ECB conducted, with higher key interest rates.

The weak Krona? Did Sweden use the opportunity to depreciate their currency? Independent of whether the depreciation was intended or not, the Swedish krona did depreciate during the financial distress following September 2008. Although the mechanism that made the Krona depreciate might have been outside the control of the Swedish central bank and not intended, it is a fact that it did, and had they been a member of a the EMU they would most possibly have never experienced such a depreciation, and hence the advantage of a slightly more competitive position this gave them.

[12] OECD's definition of general government financial balances: Government net lending is general government current tax and non-tax receipts less general government total outlays. The EU15 comprises the following 15 countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom.

Governments support to financial institutions? The amounts used on support to the financial institutions were higher in Netherlands (33, 9 % of 2008 GDP) than in Sweden (10, 9 %). What this meant for the recovery one should be careful of making explicit conclusions from. The problematic case is whether more financial support was because of the banks being in larger trouble in Netherlands, or if the willingness to bail-out banks was stronger and that the moral-hazard issues this implied was neglected.

The fiscal policy? Both countries conducted Keynesian text-book economics in the wake of the global crisis in 2008. Sweden used a higher overall amount of GDP on fiscal stimulus, and this could of course partly explain a stronger recovery. Although one might say that Sweden was in stronger need of fiscal stimulus than the Netherlands because their recession was stronger, so that more fiscal stimulus was more because of the amount demanded to bring output back to trend rather than the political will to use Keynesian policies. Anyway, the different amounts used on fiscal stimulus is independent of the membership in the EMU, and if we assume Keynesian stimulus is the source of the adverse recovery after 2010 this is independent of the Dutch' membership in the CU.

When two economic areas are exposed to the same shock both central banks reduce their rates heavily to counter the falling demand. Both the ECB and the Riksbank lowered the rates to a level where the Swedish role outside the CU and the opportunity to take advantage of interest rate differences was limited. From the indicators studied in this chapter it seems that the most apparent advantage Sweden had from staying outside the monetary union was the weakening of the Swedish krona and what this meant for their competitive position.

8 Concluding remarks

This thesis has attempted to shed some light upon the functioning of the EMU. This discussion has been presented in the light of established monetary policy and optimal currency area-theory.

The chapters two, three and four presented the framework for our further discussion, and introduced the problems that could emerge if adverse economic developments (as I presented in chapter five and six) would appear.

This paper has showed that the asymmetries between the member countries maybe became too severe, and resulted in, for some countries, ill-suited monetary policy that increased problematic developments. In chapter five we went through relevant economic indicators and assessed the differences that emerged between the EMU-members the last decade. I addressed large differences in both inflation and output-gap between the EMU-members – with the difficulties this meant for conducting optimal monetary policy for all the respective EMU-member states. Chapter five addressed the correlation between deviations from optimal interest rates pre-crisis 2008 and a negative output-gap today, though I did not identify a causal channel. This chapter, in mind my mind, served two purposes; first, addressing the need for similarity in economic performance between members of the same currency-area, and second show that the EMU-project might failed in securing convergent developments between the member states. Another argument one could take from this chapter is that creating a monetary union do not necessarily have an endogenous effect on ex ante OCA criteria. As in the case of the EMU it might made the countries diverge because of real rates becoming severely different. In chapter six I took a closer look at the deviant in the EMU, Ireland, and how their adverse economic performance resulted in ill-suited monetary policy that maybe amplified their high and problematic economic growth. From this chapter I would reason that Ireland would have benefited from a having a national central bank that could dampen the excessive economic activity that took place in the years leading up the crisis years from 2008. Chapter seven tried to assess the consequences of a EMU-membership by looking at whether differences between two approximately similar countries was a result of them being a member of a currency area or not. From this chapter I would reason that it was not straightforward to utilize the position outside the EMU for Sweden when the interconnectedness to the EMU is as strong as is present in today's economic environment.

Especially in crisis years like after 2008 when central banks' key rates is lowered near a zero lower bound, an interest rate difference to devalue the domestic currency is of limited availability. Though, the Swedish currency did this seemed to have been independent of the interest rate differences between the ECB and the Riksbank.

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Attachments

Annual values for inflation, output-gap and the ECB rate at the end of each year used for calculation of predicted interest rate using Taylor-rule. Included are values for the eleven original members from 1999, plus Greece.

GEO/TIME	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
ECB key interest rate	3,00	4,75	3,25	2,75	2,00	2,00	2,25	3,50	4,00	2,50	1,00	1,00	1,00	0,75
Euro area (17 countries) Inflation	1,20	2,20	2,40	2,30	2,10	2,20	2,20	2,20	2,10	3,30	0,30	1,60	2,70	2,50
Output-gap	0,73	2,34	2,10	1,04	-0,03	0,22	0,34	1,99	3,27	1,90	-3,55	-2,65	-2,23	-3,71
Taylor rule	3,17	5,47	5,65	4,97	4,14	4,41	4,47	5,29	5,78	6,90	-0,33	2,07	3,93	2,90
Deviation from taylor-rule	0,17	0,72	2,40	2,22	2,14	2,41	2,22	1,79	1,78	4,40	-1,33	1,07	2,93	2,15
Absolute value of deviation	0,17	0,72	2,40	2,22	2,14	2,41	2,22	1,79	1,78	4,40	1,33	1,07	2,93	2,15
Belgium inflation	1,10	2,70	2,40	1,60	1,50	1,90	2,50	2,30	1,80	4,50	0,00	2,30	3,50	2,60
Output-gap	0,37	1,78	0,45	-0,08	-0,97	0,53	0,56	1,57	2,83	2,23	-1,86	-0,64	-0,13	-1,66
Taylor rule	2,84	5,94	4,82	3,36	2,76	4,11	5,03	5,23	5,11	8,86	0,07	4,13	6,18	4,07
Deviation from taylor-rule	-0,16	1,19	1,57	0,61	0,76	2,11	2,78	1,73	1,11	6,36	-0,93	3,13	5,18	3,32
Absolute value of deviation	0,16	1,19	1,57	0,61	0,76	2,11	2,78	1,73	1,11	6,36	0,93	3,13	5,18	3,32
Germany (including former GDR from 1991)	0,60	1,40	1,90	1,40	1,00	1,80	1,90	1,80	2,30	2,80	0,20	1,20	2,50	2,10
Output-gap	-0,08	1,49	1,54	0,28	-1,21	-1,60	-1,87	0,54	2,36	1,56	-4,77	-2,10	-0,49	-1,12
Taylor rule	1,86	3,84	4,62	3,24	1,89	2,90	2,92	3,97	5,63	5,98	-1,08	1,75	4,51	3,59
Deviation from taylor-rule	-1,14	-0,91	1,37	0,49	-0,11	0,90	0,67	0,47	1,63	3,48	-2,08	0,75	3,51	2,84
Absolute value of deviation	1,14	0,91	1,37	0,49	0,11	0,90	0,67	0,47	1,63	3,48	2,08	0,75	3,51	2,84
Ireland inflation	1,63	5,56	4,88	4,64	3,49	2,20	2,41	3,94	4,92	4,05	-4,48	-0,95	2,59	1,71
Output-gap	6,19	9,84	8,56	8,26	6,65	5,80	6,66	7,51	8,49	2,03	-5,62	-7,84	-7,65	-8,17
Taylor rule	6,55	14,25	12,59	12,09	9,56	7,20	7,94	10,67	12,62	8,10	-8,53	-4,34	1,06	-0,52
Deviation from taylor-rule	3,55	9,50	9,34	9,34	7,56	5,20	5,69	7,17	8,62	5,60	-9,53	-5,34	0,06	-1,27
Absoulute value of deviation	3,55	9,50	9,34	9,34	7,56	5,20	5,69	7,17	8,62	5,60	9,53	5,34	0,06	1,27
Greece inflation	2,10	2,90	3,70	3,90	3,40	3,00	3,50	3,30	3,00	4,20	1,30	4,70	3,10	1,00
Output-gap	-1,51	-1,03	-0,81	-1,20	0,97	2,23	1,95	5,77	7,39	5,37	1,66	-2,99	-9,01	-14,00
Taylor rule	3,40	4,84	6,15	6,25	6,59	6,62	7,22	8,83	9,20	9,98	3,78	6,56	1,14	-4,50
Deviation from taylor-rule	0,40	0,09	2,90	3,50	4,59	4,62	4,97	5,33	5,20	7,48	2,78	5,56	0,14	-5,25
Absolute value of deviation	0,40	0,09	2,90	3,50	4,59	4,62	4,97	5,33	5,20	7,48	2,78	5,56	0,14	5,25
Spain inflation	2,20	3,50	2,80	3,60	3,10	3,10	3,40	3,60	2,80	4,10	-0,20	2,00	3,10	2,40
Output-gap	1,57	2,70	2,49	1,53	1,02	0,81	1,04	2,00	2,68	1,25	-3,89	-5,39	-6,14	-8,44
Taylor rule	5,09	7,60	6,45	7,17	6,16	6,06	6,62	7,40	6,54	7,78	-1,24	1,30	2,58	0,38
Deviation from taylor-rule	2,09	2,85	3,20	4,42	4,16	4,06	4,37	3,90	2,54	5,28	-2,24	0,30	1,58	-0,37
Absolute value of deviation	2,09	2,85	3,20	4,42	4,16	4,06	4,37	3,90	2,54	5,28	2,24	0,30	1,58	0,37
France inflation	0,60	1,80	1,80	1,90	2,20	2,30	1,90	1,90	1,60	3,20	0,10	1,70	2,30	2,20
Output-gap	1,15	2,62	2,21	1,27	0,57	1,30	1,57	2,64	3,23	1,41	-2,72	-2,35	-1,99	-3,17
Taylor rule	2,47	5,01	4,81	4,48	4,58	5,10	4,63	5,17	5,02	6,51	-0,21	2,38	3,46	2,71
Deviation from taylor-rule	-0,53	0,26	1,56	1,73	2,58	3,10	2,38	1,67	1,02	4,01	-1,21	1,38	2,46	1,96
Absolute value of deviation	0,53	0,26	1,56	1,73	2,58	3,10	2,38	1,67	1,02	4,01	1,21	1,38	2,46	1,96

Source: Eurostat and own calculations.

Italy inflation	1,70	2,60	2,30	2,60	2,80	2,30	2,20	2,20	2,00	3,50	0,80	1,60	2,90	3,30
Output-gap	0,39	2,74	3,01	2,04	0,80	1,21	1,29	2,63	3,34	1,49	-4,36	-2,95	-2,78	-5,21
Taylor rule	3,74	6,27	5,95	5,92	5,60	5,06	4,94	5,62	5,67	6,99	0,02	1,93	3,96	3,35
Deviation from taylor-rule	0,74	1,52	2,70	3,17	3,60	3,06	2,69	2,12	1,67	4,49	-0,98	0,93	2,96	2,60
Absolute value of deviation	0,74	1,52	2,70	3,17	3,60	3,06	2,69	2,12	1,67	4,49	0,98	0,93	2,96	2,60
Luxembourg inflation	1,00	3,80	2,40	2,10	2,50	3,20	3,80	3,00	2,70	4,10	0,00	2,80	3,70	2,90
Output-gap	1,71	4,75	2,27	1,61	-1,10	-0,90	0,52	1,96	5,39	2,94	-2,24	-0,74	-0,58	-1,67
Taylor rule	3,35	9,08	5,74	4,95	4,20	5,35	6,96	6,48	7,75	8,62	-0,12	4,83	6,26	4,51
Deviation from taylor-rule	0,35	4,33	2,49	2,20	2,20	3,35	4,71	2,98	3,75	6,12	-1,12	3,83	5,26	3,76
Absolute value of deviation	0,35	4,33	2,49	2,20	2,20	3,35	4,71	2,98	3,75	6,12	1,12	3,83	5,26	3,76
Netherlands inflation	2,00	2,30	5,10	3,90	2,20	1,40	1,50	1,70	1,60	2,20	1,00	0,90	2,50	2,80
Output-gap	1,80	2,82	2,16	-0,06	-1,63	-1,32	-0,76	1,11	3,33	3,40	-1,63	-1,08	-1,00	-2,91
Taylor rule	4,90	5,86	9,73	6,82	3,49	2,44	2,87	4,11	5,07	6,00	1,68	1,81	4,25	3,75
Deviation from taylor-rule	1,90	1,11	6,48	4,07	1,49	0,44	0,62	0,61	1,07	3,50	0,68	0,81	3,25	3,00
Absolute value of deviation	1,90	1,11	6,48	4,07	1,49	0,44	0,62	0,61	1,07	3,50	0,68	0,81	3,25	3,00
Austria inflation	0,50	2,00	2,30	1,70	1,30	2,00	2,10	1,70	2,20	3,20	0,40	1,70	3,60	2,60
Output-gap	1,44	2,82	1,59	1,11	-0,07	0,07	0,65	2,11	3,66	2,65	-2,65	-2,17	-1,28	-2,43
Taylor rule	2,47	5,41	5,24	4,11	2,91	4,03	4,47	4,61	6,13	7,12	0,28	2,46	5,76	3,69
Deviation from taylor-rule	-0,53	0,66	1,99	1,36	0,91	2,03	2,22	1,11	2,13	4,62	-0,72	1,46	4,76	2,94
Absolute value of deviation	0,53	0,66	1,99	1,36	0,91	2,03	2,22	1,11	2,13	4,62	0,72	1,46	4,76	2,94
Portugal inflation	2,20	2,80	4,40	3,70	3,30	2,50	2,10	3,00	2,40	2,70	-0,90	1,40	3,60	2,80
Output-gap	3,97	4,80	4,06	2,54	-0,10	-0,03	-0,47	-0,01	1,37	0,37	-3,11	-2,22	-3,54	-6,84
Taylor rule	6,28	7,60	9,63	7,82	5,90	4,73	3,91	5,50	5,29	5,23	-1,90	1,99	4,63	1,78
Deviation from taylor-rule	3,28	2,85	6,38	5,07	3,90	2,73	1,66	2,00	1,29	2,73	-2,90	0,99	3,63	1,03
Absolute value of deviation	3,28	2,85	6,38	5,07	3,90	2,73	1,66	2,00	1,29	2,73	2,90	0,99	3,63	1,03
Finland inflation	1,30	2,90	2,70	2,00	1,30	0,10	0,80	1,30	1,60	3,90	1,60	1,70	3,30	3,20
Output-gap	0,30	2,08	0,81	-0,49	-1,31	0,21	0,83	3,22	6,70	5,26	-4,59	-2,09	-0,36	-0,79
Taylor rule	3,10	6,39	5,45	3,75	2,29	1,26	2,61	4,56	6,75	9,48	1,10	2,51	5,77	5,40
Deviation from taylor-rule	0,10	1,64	2,20	1,00	0,29	-0,74	0,36	1,06	2,75	6,98	0,10	1,51	4,77	4,65
Absolute value of deviation	0,10	1,64	2,20	1,00	0,29	0,74	0,36	1,06	2,75	6,98	0,10	1,51	4,77	4,65